2
47
561

PHYSICS ABSTRACTS

BEING

SCIENCE ABSTRACTS—SECTION A

EDITED AND ISSUED MONTHLY BY
THE INSTITUTION OF ELECTRICAL ENGINEERS
IN ASSOCIATION WITH
THE PHYSICAL SOCIETY
THE AMERICAN PHYSICAL SOCIETY
THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

ERSITY LIBRARY

Price, Single Numbers, 3s. 6d.
Annual Subscription, 35s., including the Yearly Index
Annual Subscription, for both Sections, 60s.

Copyright.

ABSTRACTS 1923–2092

Vol. 47 SEPTEMBER, 1944 No. 561

512.894.3 : 513.10 *see Abstr.* 1932

513.10 : 512.894.3 1932

On lattice points in the domain $|xy| \leqslant 1$, $|x+y| \leqslant \sqrt{5}$, and applications to asymptotic formulae in lattice point theory. I–II. MAHLER, K. *Proc. Camb. Phil. Soc.*, 40, *pp.* 107–120, *June*, 1944.—Definitions are given of finite and infinite star domains K. The lattice Λ given by $x = \alpha h + \beta k$, $y = \gamma h + \delta k$ $(h, k = 0, \pm 1, \pm 2 \ldots)$, of determinant $|\alpha\delta - \beta\gamma|$ is called K-admissible if the origin $O = (0, 0)$ is the only inner point of K contained in Λ. $\Delta(K)$ is the lower bound of $|\alpha\delta - \beta\gamma|$ extended over all K-admissible lattices. Now let K denote the finite star domain $|xy| \leqslant 1$, $|x+y| \leqslant \sqrt{5}$. It is shown that $\Delta(K) = \sqrt{5}$; i.e. every lattice Λ of determinant $|\alpha\delta - \beta\gamma| \leqslant \sqrt{5}$ contains at least 1 point of K different from O, but lattices of greater determinant need not have this property. It is also shown that K is a min. subset of the infinite star domain $|xy| \leqslant 1$ with $\Delta(K) = \sqrt{5}$, i.e. if $H \neq K$ is any star domain contained in K, then $\Delta(H) < \Delta(K)$. An asymptotic formula is found for the min. determinant $\Delta(G)$ of the domain $G: |x|^\alpha + |y|^\alpha \leqslant 1$, where α is a small pos. number, $\to 0$. It is shown that $\Delta(G) \sim 2^{-2/\alpha}\sqrt{5}$. An asymptotic formula is also found for the min. of a pos. definite binary quartic form $f(x, y)$, for integral x, y not both zero, when the discriminant of $f(x, y)$ is given and the abs. invariant $\to \infty$. L. S. G.

513.623 : 511.5 *see Abstr.* 1926

513.623 : 511.53 *see Abstr.* 1928

513.623 : 511.53 : 511.473 *see Abstr.* 1925

513.624.92 1933

On the quartic surface $x_1^4 + x_2^4 + x_3^4 + x_4^4 = 0$. SEGRE, B. *Proc. Camb. Phil. Soc.*, 40, *pp.* 121–145, *June*, 1944.—A detailed study is made of this surface, denoted by F, commencing with the projective transformations of F into itself (these form a group of 1 536 collineations), the 48 lines of F and the flecnodal curve which consists of these lines (each taken once) and the sections of F by the fundamental tetrahedron (each taken twice). There is a geometric characterization of F and there are 6 different types of F in the real domain. A notation is introduced for the lines on F and a study of the incidence conditions for these is made. There are 320 irreducible conics of two different types on F, but no unicursal plane cubic curves. On the other hand, there are some twisted cubic curves on F and some twisted quartics both of the first and second kind. It is proved that F contains a discrete infinity of unicursal curves and a construction for these is given, based on the construction of an infinite discontinuous group of birational transformations of F into itself. L. S. G.

517.392 1934

Coefficients for numerical integration with central differences. SALZER, H. E. *Phil. Mag.*, 35, *pp.* 262–264, *April*, 1944.—A numerical table is given of the coefficients $M_{2s}(s = 1, 2, \ldots, 28)$ in the following central difference formula for numerical integration

$$\frac{1}{\omega}\int_a^{a+n\omega} f(x)dx = L + M + N,$$

where $L = \frac{1}{2}\{f(a) + f(a+n\omega)\} + \sum_{i=1}^{n-1} f(a+i\omega)$,

$$M = \sum_{s=1}^{m-1} M_{2s}\{\mu\delta^{2s-1}f(a+n\omega) - \mu\delta^{2s-1}f(a)\},$$

$$N = n\omega^{2m}M_{2m}f^{(2m)}(\xi).$$ L. S. G.

517.43 : 621.3.012.8 1935

Mathematical methods applicable to linear phenomena. WHITEHEAD, S. *J. Sci. Instrum.*, 21, *pp.* 73–80, *May*, 1944.—The paper shows that mathematical methods are systematic forms of commonplace physical ideas. Illustrations are taken mostly from electric circuits. The topological properties of circuit and other diagrams are described, and the use of matrices is discussed in obtaining solutions of circuit problems. The use of integral forms (Laplace and Fourier transforms) for transient phenomena is pointed out. L. S. G.

517.5 : 519.53 *see Abstr.* 1952

517.5 : 533.662 1936

On the limiting values for infinite pitch of a parameter occurring in airscrew theory. GOLDSTEIN, S. *Proc. Camb. Phil. Soc.*, 40, *pp.* 146–150, *June*, 1944.—The parameter is K and it occurs in the formula $4\pi rKw_1 \sin\phi = N\Gamma$ which, for an airscrew with N blades, connects the total interference velocity w_1 and the circulation Γ at radius r. Let $x = r/R$ where R is the radius of the airscrew. It is known that $K = \frac{N}{2\pi x^2}\sum_{m=1}^{\infty} A_{Nm} \sin m\theta$ where $\cos^2\theta/2 = x^N$ [Abstr. 59 (1937)] but it is difficult to compute K from this formula when $N = 3$. By suitable transformations of the Fourier series, other formulae are derived for K according as $x \ll 1$ or $x \approx 1$. For intermediate values of x we have

$$K = \frac{N}{\pi^{3/2}}\frac{\Gamma(\frac{1}{2} + n)}{\Gamma(n)}\int_0^{\theta/2} (\sec y)^{2n}dy$$

where $n = 2/N$. These formulae are all convenient for computing values of K for infinite pitch. L. S. G.

517.512.2 1937

Notes on Fourier series (1): on sine series with positive coefficients. HARDY, G. H., AND ROGOSINSKI, W. W. *J. Lond. Math. Soc.*, 18, 1, *pp.* 50–57, 1943.—Suppose that $f(\theta)$ is odd and integrable and that its Fourier series is $S(\theta) = \sum b_n \sin n\theta$. By

$$f(\theta) \to \tfrac{1}{2}\pi A(C, \alpha) \quad (1.1)$$

where $\alpha > 0$, when $\theta \to +0$, we mean that

$$\frac{\alpha}{\theta^\alpha}\int_0^\theta (\theta - t)^{\alpha-1}f(t)dt \to \tfrac{1}{2}\pi A \quad (1.2)$$

and by $nb_n \to A(C, \beta)$, where $\beta > 0$ (1.3)

we mean that the Cesàro mean of nb_n, of order β, tends to A. When $\alpha = \beta = 1$, (1.2) and (1.3) become

$$\frac{1}{\theta}\sum\frac{b_n}{n}(1 - \cos n\theta) \to \tfrac{1}{2}\pi A \quad (1.4)$$

(1.5): $n^{-1}(b_1 + 2b_2 + \ldots + nb_n) \to A$. The following five theorems are proved: (I) If b_n is positive and decreasing then a necessary and sufficient condition, either for the uniform convergence of S or for the continuity of f, is that $nb_n \to 0$. (II) If b_n is positive and decreasing, and $A > 0$, then a necessary and sufficient condition that $f(\theta) \to \frac{1}{2}\pi A$, is that

$nb_n \to A$. (III) If $b_n \geqslant 0$, or if (1.6): $nb_n \geqslant -1$, then (1.5) is necessary and sufficient for (1.4). (IV) If b_n satisfies (1.6), and f is continuous, then S is uniformly convergent. (V) If b_n satisfies (1.6), then (1.3), for any $\beta \geqslant 1$, is necessary and sufficient for (1.1), for any $\alpha > 0$. L. S. G.

517.512.2 1938

Note on the theory of series (XXIII): On the partial sums of Fourier series. HARDY, G. H., AND LITTLEWOOD, J. E. *Proc. Camb. Phil. Soc.*, 40, *pp.* 103–107, *June*, 1944.—Let $f(\theta)$ be a periodic function of L^2 and $T(\theta) = \frac{1}{2}A_0(\theta) + \sum_1^\infty A_n(\theta)$ be its Fourier series where $A_n(\theta) = a_n \cos n\theta + b_n \sin n\theta$. Let $s_n(\theta) = \frac{1}{2}A_0(\theta) + \sum_1^n A_n(\theta)$ be the nth partial sum and $n(\theta)$ any measurable function which is finite almost everywhere and assumes only non-negative integral values. Define $A_n^*(\theta)$ by $A_n^*(\theta) = A_n(\theta)/\{\log(n+2)\}^{1/2}$ and let $s_n^*(\theta)$ be derived from $A_n^*(\theta)$ in the same way as $s_n(\theta)$ is derived from $A_n(\theta)$. It is proved that

$$\int_{-\pi}^{\pi} |s^*_{n(\theta)}(\theta)|^2 d\theta \leqslant C \int_{-\pi}^{\pi} |f(\theta)|^2 d\theta \text{ for all } n(\theta)$$

where C is constant. The relation of this inequality to others of a like type is examined. L. S. G.

517.512.2 : 517.946 : 534.113 1939

General vibration of a hinged beam. BROWN, H. K. *J. Appl. Phys.*, 15, *pp.* 410–413, *May*, 1944.—[See Abstr. 790 (1944)]. A general boundary-value problem of the transverse vibrations of a hinged beam is resolved into the solution of a pair of boundary-value problems with simpler boundary conditions. The finite sine transformation and its property of convolution are used. The transformed boundary-value problem is solved by the introduction of a fundamental set of solutions of the homogeneous transformed problem.

517.522 : 517.949 *see Abstr.* 1946

517.54 : 532.516 1940

Solutions of some problems in viscous flow. GREEN, G. *Phil. Mag.*, 35, *pp.* 250–262, *April*, 1944.—Two-dimensional small steady motion of a fluid of const. density is considered. Under these conditions p/μ and ζ (the vorticity) are conjugate functions, i.e. $p/\mu - i\zeta$ is an analytic function of the variable $z = x + iy$. The method is to express $x + iy$ as a function of $\xi + i\eta$ where ξ and η are variables chosen to suit the special boundary form in each particular problem. The stream function (ψ) may be found by solving the equation $\Delta^2\psi = -\zeta$ or, when ψ is expressed in curvilinear co-ordinates, by solving $\Delta^2\psi = -h_1h_2\zeta$. Three special problems are examined: (1) Flow within converging plane walls, $x + iy = ce^{\alpha(\xi+i\eta)}$; (2) flow within hyperbolic boundaries, $x + iy = c\cosh(\xi + i\eta)$; (3) flow into a parallel channel,

$$x + iy = \{1 + \pi(\xi + i\eta)/c + e^{\pi(\xi+i\eta)/c}\}h/\pi$$

L. S. G.

517.9 : 550.341 1941

Mathematical questions in seismology. RICHTER, C. F. *Bull. Amer. Math. Soc.*, 49, *pp.* 477–493, *July*, 1943.—Differential equations involved are of 3 types: equations of motion of the recording instruments (I), or of elastic solid bodies (II), or equations of propagation of elastic waves in the interior of the earth (III). These are all discussed. The equations of set II reveal the existence of 2 types of elastic waves, the first being physically identical with sound waves, while in the second type the displacement is a pure shearing and is transverse to the direction of propagation (polarization may occur). As soon as a boundary exists, other types of waves are possible and the simplest are the Rayleigh surface waves. The equations of set III are identical with the fundamental equations of geometrical optics, such as Fermat's principle $\delta\int ds/v = 0$, and the "eikonal" equation which, for a spherically symmetrical earth, is $(\partial t/\partial r)^2 + r^{-2}(\partial t/\partial\theta)^2 = v^{-2}$ where r, θ, ϕ are polar co-ordinates. This equation can be made the basis for a complete discussion of the geometrical optics of seismology. L. S. G.

517.925 : 519.213 1942

Note on events distributed according to chance. RUARK, A. E. *Phys. Rev.*, 65, *p.* 287, *May* 1 *and* 15, 1944.—[See Abstr. 1226 (1944)].

517.93 1943

A theory for ordinary differential boundary problems of the second order and of the highly irregular type. LANGER, R. E. *Trans. Amer. Math. Soc.*, 53, *pp.* 292–361, *March*, 1943.—The boundary problems studied are of the type $u''(x) + f(x)u'(x) + g(x)u(x) = 0$, where $f(x) = \lambda p_{11}(x) + p_{10}(x)$, $g(x) = \lambda^2 p_{22}(x) + \lambda p_{21}(x) + p_{20}(x)$, and the boundary conditions are $h_{i1}(\lambda)u'(a) + h_{i2}(\lambda)u(a) + h_{i3}(\lambda)u'(b) + h_{i4}(\lambda)u(b) = 0$ $(i = 1, 2)$. These are classified into regular, mildly irregular and highly irregular types, a relatively complete theory already existing for the first two types. To study the third type, the author embeds the highly irregular problem in a continuous family of boundary problems of which all the other members are regular. The given problem is thus approached through limiting considerations applied to existing theory. L. S. G.

517.942 1944

Some simple differential difference equations and their related functions. BATEMAN, H. *Bull. Amer. Math. Soc.*, 49, *pp.* 494–512, *July*, 1943.—Six different methods are outlined for solving equations of the type

$$Md^2u_n/dt^2 + 2Kdu_n/dt + Su_n = (na + a + b)(u_{n+1} - u_n) - (na + c)(u_n - u_{n-1})$$

in which M, K, S, a, b, c are constants. In the method of simple solutions we have $u_n(t) = u_n(p)\exp(ipt)$, where p is a const., assuming a certain set of values. The method of generating functions consists in writing $G(z, t) = \sum z^n u_n(t)$ and forming a differential equation satisfied by $G(z, t)$. In the method of definite integrals we write $u_n(t) = \int z^n f(z, t)dz$, and the operational method depends on the formation of a difference equation satisfied by $u_n(x) = \int_0^\infty e^{-xt}u_n(t)dt$. There is also a power-series method and a method of successive approximation. The equation $du_n/dt = K_{n-1}u_{n-1} - K_nu_n$ occurs in the theory of probability and in the theory of chain processes in chemistry and radioactivity. In the case of a pendulum consisting of a light string with equal masses equally spaced and

a large mass at the end, the equation of small vibrations is of the type

$$m\ddot{x}_n + Sx_n = (M + nm)(x_{n+1} - x_n) - (M + nm - m)(x_n - x_{n-1})$$

The solution of this equation is discussed. The next application is to surges in springs and connected systems of springs. [See Abstr. 2722 (1939)]. The equations of Born and Karman,

$$d^2x_{2n}/dt^2 = a^2(x_{2n+1} + x_{2n-1} - 2x_{2n})$$
$$d^2x_{2n+1}/dt^2 = b^2(x_{2n+2} + x_{2n} - 2x_{2n+1})$$

relating to vibrations in crystal lattices, are discussed at some length, and the paper concludes with the treatment of elastic waves in a lattice. L. S. G.

517.946 : 534.113 : 517.512.2 *see Abstr.* 1939

517.949 1945

An inequality for Hausdorff means. HARDY, G. H. *J. Lond. Math. Soc.*, 18, 1, *pp.* 46–50, 1943.—The Hausdorff mean, b_n, of a sequence (a_n) is defined by $b_n = \sum_{m=0}^{n} \binom{n}{m} \mu_{m,\,n-m} a_m$, where $\mu_{m,\,p} = \Delta^p \mu_m$, $\Delta\mu_m = \mu_m - \mu_{m+1}$ and $\mu_m = \int_0^1 t^m d\chi(t) (m = 0, 1, 2 \ldots)$.

In the case of a regular transformation, where χ increases with t, $\chi(0) = \chi(+0)$ and $\chi(1) = 1$, the following theorem is proved: If $a_n \geqslant 0$ and $p > 1$, then $\sum b_n^p < K(p) \sum a_n^p$, where $K(p) = \left(\int_0^1 t^{-1/p} d\chi \right)^p$, unless $a_n = 0$ for all n or the transformation reduces to the identity. The value of $K(p)$ is the best possible. Examples are given, some of which are as follows: (i) If $\chi = t$, then $b_n = (a_0 + a_1 + \ldots + a_n)/(n+1)$ and $K(p) = \left(\frac{p}{p-1} \right)^p$. (ii) If $\chi' = \alpha(1-t)^{\alpha-1}$, where $\alpha > 0$, then b_n is the Cesàro mean, of order α, of a_n. In this case $K(p) = \left\{ \frac{\Gamma(1+\alpha)\Gamma(1-1/p)}{\Gamma(1+\alpha-1/p)} \right\}^p$ (iii) For the Hölder means, $\chi' = (-\log t)^{\alpha-1}/\Gamma(\alpha)$, $K(p) = \left(\frac{p}{p-1} \right)^{\alpha p}$, a result which follows from (i) by iteration when α is an integer. L. S. G.

517.949 : 517.522 1946

A theorem on finite differences with an application to the theory of Hausdorff summability. FUCHS, W. H. J. *Proc. Camb. Phil. Soc.*, 40, *pp.* 188–197, *June*, 1944.—Let $t_n = \Delta^n s_0 = \sum_{k=0}^{n} (-)^k \binom{n}{k} s_k$. If $t_n = 0$ for all integers $n \geqslant 0$, then $s_n = 0$ for all n, but this is no longer true if it is only known that $t_n = 0$ for an infinity of n. However, let $a_1 < a_2 < \ldots$ be pos. integers, $n(R)$ the number of a's not exceeding R, and s_n a sequence of complex numbers. Then we have the theorem: if $n(R) \geqslant \frac{1}{2}R$ for $R > R_0$, $s_n = o(n^k)$ as $n \to \infty$, $\Delta^p s_0 = 0\,(p = a_1, a_2, \ldots)$, then $s_n = P(n)$, where $P(x)$ is a polynomial of degree less than k. The proof of this theorem makes use of some facts about the closure of sets of functions of the form $\{e^{-cx} x^{\alpha_\nu}\}$ and these are first studied. An application of the theorem is made showing that a theorem of Rogosinski on Hausdorff summability [Abstr. 968 (1942)] ceases to be true under certain conditions. L. S. G.

517.949.8 : 532.526 1947

The solution of an equation in the boundary-layer theory by the method of finite differences. PISKOUNOV, N. S. *C.R. Acad. Sci. URSS*, 37, 5–6, *pp.* 157–159, 1942.—The equation is $\partial z/\partial x = \sqrt{\{\theta(x) - z\}}\,\partial^2 z/\partial y^2$ where $\theta(x)$ is the square of the velocity of flow on the external border of the boundary layer, and the boundary conditions are $z(x, o) = \theta(x)$, $z(o, y) = \phi(y)$, $z(x, \infty) = 0$. It is replaced by the difference equation

$$\{z(x+h, y) - z(x, y)\}/h = \sqrt{\{\theta(x) - z\}}\,D$$

where $D = \{z(x, y+l) - 2z(x, y) + z(x, y-l)\}/l^2$. On writing $h = l^2/p$, $x = nh$, $y = ml$, this becomes $z_{n+1,\,m} - z_{n,\,m} = \frac{1}{p} \sqrt{\{\theta - z_{n,\,m}\}}\,\Delta^2 z_{n,\,m}$. The sequence of solutions of this system of equations, subject to $z_{no} = \theta(nh)$, $z_{om} = \phi(ml)$, is convergent for $l \to 0$ and the limiting function satisfies the original equation under its boundary conditions. L. S. G.

519.1 1948

Three identities in combinatory analysis. DYSON, F. J. *J. Lond. Math. Soc.*, 18, 1, *pp.* 35–39, 1943.—Writing $x_n = 1 - x^n$ it is proved that

$$\prod_{n=0}^{\infty} \{1/x_{7n+1} x_{7n+2} x_{7n+5} x_{7n+6}\} = \sum_{n=0}^{\infty} x^{2n^2} A/P_n Q_n$$

where

$$A = \prod_{i=1}^{\infty} (1+x^i),\ P_n = \prod_{i=1}^{n} (1-x^{2i}),\ Q_n = \prod_{i=1}^{2n} (1+x^i)$$

Two similar identities are also proved. L. S. G.

519.213 : 517.925 *see Abstr.* 1942

519.41 1949

Adjunction of elements to groups. NEUMANN, B. H. *J. Lond. Math. Soc.*, 18, 1, *pp.* 4–11, 1943.—A process is studied of embedding one group G in another. If $w(x)$ is a word in the indeterminate x, having coefficients in G, then, in the case where $w(x) = 1$ has no solution in G, a group H, having G as a subgroup, may be generated by adjoining to G a solution of $w(x) = 1$. The adjunction may be impossible, e.g. when a and b are 2 elements in G of different orders and $w(x) = a^{-1}x^{-1}bx$. However, the necessary and sufficient condition is given in order that the adjunction be possible. An important theorem is that all groups, if any, obtainable from G by adjunction are homomorphic images of one "greatest" such group, called the "free" extension of G. Adjunctions to a group with automorphisms are studied and examples are given. L. S. G.

519.41 1950

On the number of generators of a free product. NEUMANN, B. H. *J. Lond. Math. Soc.*, 18, 1, *pp.* 12–20, 1943.—The min. number of generators of a group G is denoted by $m(G)$ and $P = A_1 * A_2 * \ldots * A_n$ is the free product of the groups $A_1, \ldots, A_n$. A proof is given of the result

$$m(P) = m(A_1) + m(A_2) + \ldots + m(A_n)$$ L. S. G.

519.443 1951

On the theory of characters of groups and semi-groups in normed vector rings. HILLE, E. *Proc. Nat. Acad. Sci., Wash.*, 30, *pp.* 58–60, *March*, 1944.—R is a normed commutative vector ring and M a maximal ideal in R. S is a set of elements of R which form a group under the operation of ring multiplication.

or every ideal M in R, a bounded linear multiplica-ve functional, $\mu(x; M)$, is defined, which, for x in S, efines a continuous one-dimensional representation (M) of S, $\mu(x; M)$ being the characters of the repre-ntation. Various theorems are proved concerning ese characters and the results are extended in part semi-groups. L. S. G.

19.53 : 517.5 1952

Measurable functions. FRANKLIN, P. *J. Math. hys.*, 23, *pp.* 24–44, *Feb.*, 1944.—The paper com-ences with a series of theorems on the approxima-on of measurable functions, summable functions, d Riemann integrable functions. A modification given of Caratheodory's classification of bounded easurable functions on a finite interval. A defini-on is also given, uniquely for a set of equivalent nctions, of two functions, either of which may epresent the set. Their relation to Kempisty's pprox. limits is discussed and it is shown that they orrectly represent the function as to Baire classifica-on. Some properties are proved of functions quivalent in the sense of Besicovitch. L. S. G.

25.624 1953

The lunar atmospheric tide at Bangalore (1895–904). SESHACHAR, C., AND THIRUVENKATACHAR, . R. *Proc. Indian Acad. Sci. A*, 19, *pp.* 131–134, *larch*, 1944.—The semi-diurnal component of the nnual mean tide at Bangalore may be represented by $6 \sin (2t + 84°)$. The seasonal variation of the de is similar to that at most other stations in that the mplitude and phase are min. in winter. The de-endence on lunar distance is well shown, the ampli-ude at apogee being $<<$ that at perigee. A com-arison of the results for Bangalore and other stations t different altitudes suggests that the amplitude iminishes with increasing altitude.

30.1 : 159.1 *see Abstr.* 1923

30.12 : 531.18 1954

Kinematic relativity. WILSON, W. *Phil. Mag.*, 5, *pp.* 241–249, *April*, 1944.—It is argued that Milne's formula for the acceleration of a free particle annot be correct because it equates a quantity which s not a space-vector to a quantity which is. Three orms of the argument supporting this conclusion are iven. It is, however, shown that this objection is emoved if the acceleration is zero, i.e. if the free article coincides with a fundamental particle. But his has the effect of reducing Milne's dynamics to hat of special relativity. G. C. McV.

30.12 : 531.51 1955

Birkhoff's theory of gravitation and Einstein's heory for weak fields. BARAJAS, A. *Proc. Nat. cad. Sci., Wash.*, 30, *pp.* 54–57, *March*, 1944.—Weyl as suggested that Birkhoff's theory [Abst. 79 (1944)] s much the same as a limiting form of Einstein's theory or weak fields, obtained by writing, in the equations f Einstein's theory, $g_{ik} = \delta_{ik} + h_{ik}$ and neglecting igher powers of h_{ik}. By examining formulae for the displacement of the perihelion of Mercury and the gravitational shift of spectral lines, it is shown that his degenerate form is fundamentally different from Birkhoff's theory and is unsatisfactory from a physical oint of view. L. S. G.

30.12 : 531.51 : 537.1 1956

The point charge in the unitary field theory. SCHRÖDINGER, E. *Proc. Roy. Irish Acad.*, 49*A*, *pp.* 225–235, *Feb.*, 1944.—The spherically symmetrical case of the author's field equations in his unified theory [Abstr. 2514 (1943)] of electromagnetism and gravitation is solved in detail. The solution corresponds to a point charge whose gravitational, as well as its electromagnetic, effect is taken into account. The point charge in a space of spherical curvature is also discussed, though it is not explained with what distribution of matter or electromagnetic energy this general curvature is connected. It is said that this case shows that the universe as a whole need not be electrically neutral, an isolated point charge being possible. G. C. McV.

530.12 : 537.1 1957

Unitary field theory: conservation identities and relation to Weyl and Eddington. SCHRÖDINGER, E. *Proc. Roy. Irish Acad.*, 49*A*, *pp.* 237–244, *Feb.*, 1944.—The author discusses the energy-tensor density yielded by his unified field theory [Abstr. 2514 (1943)] and shows that it can be thrown into a form analogous to the Maxwellian energy tensor. He also derives the conservation laws in their simplest form. Lastly, the relationship of the theory to those of Weyl and Eddington is considered. The author's theory differs from Weyl's in that the change of gauge depends not only on the amount of the infinitesimal displacement but also on its direction. On the other hand, the theory is a special case of Eddington's general unified field theory. G. C. McV.

530.145 : 538.3 *see Abstr.* 2060

531.18 : 530.12 *see Abstr.* 1954

531.25 1958

Equilibrium of a thin slab on an elastic foundation of finite depth. HOGG, A. H. A. *Phil. Mag.*, 35, *pp.* 265–276, *April*, 1944.—A theoretical investigation of a system composed of a uniform layer of elastic material resting on a perfectly rough rigid horizontal base, and a thin elastic slab of infinite extent which rests on the upper surface of the layer. The solution is given in the form of an infinite integral, and numerical results for the displacement of the slab are given in tables for a range which may be of practical use. G. E. A.

531.25 = 3 1959

Contributions to the calculation and development of composite plate girders. STÜSSI, F. *Schweiz. Bauztg*, 121, *pp.* 87–89, *Feb.* 20, *and pp.* 102–103, *Feb.* 27, 1943.—The first part treats of composite wooden I-beams of uniform depth with a web formed of 2 layers of oblique crossed strips, and the statics of the structure is explained; the strips do not take up any part of the b.m. The box form of web is not recommended. The case is examined of a steel beam with strips added above and below and fastened on the beam centrally with at least 2 pairs of rivets. Uncertainties as to the magnitude of the actual forces on the rivets and the non-uniform distribution of force on a long row of rivets are clarified. G. E. A.

531.25 = 3 1960

Contribution to the calculation of continuous bent girders. PERL, H. *Schweiz. Bauztg*, 121, *pp.* 299–302, *June* 19, 1943.—In calculations of ferroconcrete constructions of continuous bent girders, neglect of torsional resistance leads to erroneous results when found by the usual statistical method. Suitable

strengthening at the bends is necessary and worked examples show that calculations of bent beams, made by means of derived continuity equations, offer no difficulty and little additional work. G. E. A.

531.25 = 3 1961

Graphic statics of deformation problems. AMSTUTZ, E. *Schweiz. Bauztg*, 122, *pp.* 37–39, *July* 24, 1943.—The author finds a correspondence between the problems of the loaded beam and the bent ring, in which the stiffness radius of the beam is represented by the radius of the ring, and then deals with the ring problem graphically. The method is explained and applied to an example in which the moments and shear stresses in a hall pillar are determined by the graphical method. G. E. A.

531.252 : 621.821 1962

Graphical solution of stresses in shafts. PICKETT, G. A. *Engineering*, 157, *pp.* 361–362, *May* 12, 1944.—A method of analysis is described which deals with loadings that lie wholly in 2 planes. It is applicable only to circular shafts, and determines the magnitudes of the resultant moments and stresses. A simple construction can be used for any loading which produces 2 b.m.'s, each of which lies wholly on one side of the axis. If points of contraflexure occur, the construction is slightly different. G. E. A.

531.258 1963

Analysis of stretch-forming double-curved sheet-metal parts. GLASSCO, R. B., AND MYKLESTAD, N. O. *Trans. Amer. Soc. Mech. Engrs*, 66, *pp.* 161–168, *April*, 1944.—Double-curved surfaces, typical in aircraft design, are classified according to direction of curvature. A qualitative stress analysis is made of stretch-forming (clamping metal sheet at 2 opposite edges and forcing a punch into the taut sheet) each class of surface, with sp. ref. to the stress transverse to the direction of restraint. The resultant stress may be tension or compression, depending upon the direction and amount of curvature. When the resultant is compression, undesirable wrinkling of the sheet may occur.

531.259 1964

A two-dimensional approach to three-dimensional framework problems. COX, H. R. *J. Lond. Math. Soc.*, 18, 1, *pp.* 20–23, 1943.—Graphical methods are given for obtaining information regarding the completeness or redundancy of a framework, and a theorem is proved by means of which it is possible to build simply stiff 3-dimensional frameworks. L. S. G.

531.51 : 530.12 *see Abstr.* 1955

531.51 : 537.1 : 530.12 *see Abstr.* 1956

531.537 1965

On the motion of a pendulum in a turbulent fluid. LIN, C. C. *Quart. Appl. Math.*, 1, *pp.* 43–48, *April*, 1943.—The effect of the fluid is considered as a continuous fluctuating force and Fourier-integral theory is used in studying the motion. An expression is derived for the correlation function of the displacement and this agrees with that obtained by Schumann [Abstr. 1235 (1942)]. L. S. G.

531.72 : 532.691 : 541.183 = 3 1966

On the applicability of the radioactive-indicator method for determining the surface of solid bodies. II. IMRE, L. *Kolloid Z.*, 106, *pp.* 39–46, *Jan.*, 1944.—The surface of a solid body may be determined by evaluation of permutoidal ion adsorption at the boundary between solid and liquid phases [Abstr. 1871 (1943)]. The activation factor (the fraction of the wall particles which is exchangeable against the impinging ions) and the symmetry factor (the ratio of the number of active points of a certain kind to the total number of wall particles of the same kind) are discussed. The former is determined experimentally by its temperature dependence. Thermodynamic considerations show the interface potential to be different from Nernst's electrode potential. This difference is a measure of asymmetry for the case of pure saturated solutions of the adsorbent. R. N.

532.13 : 532.712 : 541.24 *see Abstr.* 2087

532.13 : 532.77 = 3 1967

On the state of solution of high polymers. III. Measurements of viscosity of viscose solutions. TAKEI, M. *Kolloid Z.*, 106, *pp.* 30–35, *Jan.*, 1944.—Measurements were made of viscose solutions (cellulose xanthogenate) of different conc. and different degrees of maturing. Tables and graphs show the influence of preliminary and final maturing on solvation and particle size with different conc. of NaOH and CS_2. The results show that the viscose particles in spinning solutions have an ordered lattice structure with fringe-shaped micelles in which the reactions take place during the xanthogenation. [See Abstr. 1021, 2417 (1942)]. R. N.

532.13 : 532.77 = 3 1968

Viscosity measurements of aqueous solutions of sugar and sodium-phosphate. ROSSMANN, B., AND KAYSER, E. *Kolloid Z.*, 106, *pp.* 36–39, *Jan.*, 1944.—The viscosity of solutions of glucose, fructose and saccharose of 1–6% at 20°C. was determined with Höppler's viscometer, without and with an additional amount of 0·2–1·2% Na_2HPO_4. The values for the 3 kinds of sugars were equal, at the observed range, the relation of viscosity/conc. is linear; at higher conc. viscosity probably increases more rapidly. The relations between refr. index, viscosity and density, agree with previous results. R. N.

532.13 : 532.771 = 3 1969

Contributions to the theory of viscosity of solutions of macromolecular substances. II. Attempt at a simple theory of viscosity of very dilute macromolecular solutions, based on the varying shape of the chains. HERMANS, J. J. *Kolloid Z.*, 106, *pp.* 22–29, *Jan.*, 1944.—A quantitative explanation of the increase in viscosity (Staudinger) is attempted by considering the dissolved macromolecules as crumpled balls deformed by the field of flow when a velocity gradient is applied. The shearing modulus may be calculated statistically. The relaxation time required for the deformed molecules to return to the more probable shape is calculated with and without considering diffusion. The product of shearing modulus and relaxation time is the contribution of the dissolved molecules to the viscosity. The influence of solvent and temperature are discussed. R. N.

532.13 : 539.501 : 541.182 : 677 197

Flow characteristics of dispersions of cotton and regenerated cellulose rayon fabrics in cuprammonium. JELINEK, V. C. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *pp.* 172–179, *March*, 1944.—Flow/pressure

nd fluidity/velocity-gradient graphs were used to etermine the flow properties of cuprammonium dis- ersions of cellulose fabrics and to evaluate the method f calculating the fluidity values. The limits of appli- ation of the kinetic-energy and velocity-gradient djustments were determined under conditions similar o those recommended by the Amer. Soc. for Test. Mater. The viscometer and buretic consistometer ere compared in the fluidity technique.

532.13 : 677.11 1971

Fluidity determinations on flax cellulose. WHITE, V. A. S., AND RICHARDSON, T. N. *J. Text. Inst. Manchr*, 35, *pp.* T53–T60, *May*, 1944.—The disadvantages associated with the insoluble matter in flax do not constitute an insuperable obstacle towards the development of a simple form of fluidity estimation. As far as the conc. correction is concerned, the material may be purified by a 6 hr. boil in 2% NaOH solution and then assumed to contain 2% of insoluble non-cellulosic matter. In the determination of cellulose solubility it is permissible to assume constancy in the amount of non-cellulosic matter contained in the alkali-scoured material. Flax cellulose solutions in 2*N* aq. dimethyl dibenzyl ammonium hydroxide are much less sensitive to air than in cuprammonium solution and can be filtered in presence of air through glass wool in the same manner as the filtration is performed, during determination of cellulose solubility number. The addition of 0·02% pyrogallol also enables the cuprammonium solution of cellulose to be filtered in presence of air without appreciable change in the fluidity, and a simplified form of fluidity test for linen is described which is based on this discovery. H. H. HO.

532.133 : 541.18.043 : 541.24 *see Abstr.* 2086

532.137 = 3 1972

Structural viscosity of the mucins and a new apparatus for its measurement. ZAMBONI, P. *Kolloid Z.*, 102, *pp.* 246–251, *March*, 1943.—The instrument consists of an inclined capillary connected at either end with a vertical glass tube, in N-form. The pressure on the liquid column is varied by tilting the system. The viscosity of mucins in different solvents, especially in the presence of various salts, was studied. R. N.

532.14 : 547.599.6 : 535.324 *see Abstr.* 2001

532.516 : 517.54 *see Abstr.* 1940

532.517.4 1973

The paths of the particles in a vortex street. MORTON, W. B. *Proc. Roy. Irish Acad.*, 49*A*, *pp.* 289–292, *March*, 1944.—In continuation of previous work [Abstr. 4024 (1932)] the author investigates mathematically the paths of particles in a Karman vortex street. The analysis demonstrates the existence of special motion-curves having nodes and implying the existence of a double row of singular points which move in fixed-station relation to the vortices, keeping in transverse line with them. The particles fall into three classes, viz. (1) those that continually whirl round the same vortex; (2) those that zig-zag from one side of the street to the other, circling round vortices of two rows alternately, and (3) those that sway in and out as the vortices pass, keeping a const. mean distance and progressing more and more slowly with increasing distance from the street. J. S. G. T.

532.522 1974

Efflux through a circular orifice. BAUER, S. G. *Proc. Roy. Soc. A*, 182, *pp.* 347–361, *June* 16, 1944.—The methods of approach were based on analogies with electric circuit theory, and an apparatus was built in which the equivalent of a.c. experiments with resonant circuits could be performed. An orifice in the apparatus represented the inertia in the resonant system. The inertance of the orifice was measured at a wide range of finite amplitudes, by observations of phase shift between power input and displacement at the orifice. The effective mass or inertance of the fluid flowing through the orifice was deduced. There appear to be 3 distinct modes of flow, as compared with the 2 commonly observed in the steady state. The contraction coefficient of the flow through the orifice was found to be unity for small amplitudes and to approach the steady-state value for large amplitudes. The differential equation of the efflux through a suddenly opened orifice is stated and its solution given. A numerical example is worked out. A suction effect must follow a discharge. This suction and the following oscillations are practically independent of the pressure in the vessel before the discharge, provided this pressure is above a certain value.

532.525 1975

On under-expansion in a steam nozzle, with reference to an unusual case. KASTNER, L. J. *Phil. Mag.*, 35, *pp.* 276–282, *April*, 1944.—A gaseous fluid is under-expanded when, after expansion in a nozzle, it issues with a pressure $>$ the external pressure. Expressions are found for energy loss and max. velocity for the case of a convergent-divergent nozzle, and the loss is reduced when the jet is allowed to gain velocity after leaving the nozzle, but may be made relatively high if the jet is made to do work as soon as it leaves the nozzle. Particulars are given of an example of under-expansion in an exhaust steam injector, from which it is concluded that the losses due to under-expansion in a nozzle are seldom likely to be serious. G. E. A.

532.526 : 517.949.8 *see Abstr.* 1947

532.542 1976

Pressure loss in elbows and duct branches. VAZSONYI, A. *Trans. Amer. Soc. Mech. Engrs*, 66, *pp.* 177–183, *April*, 1944.—The pressure loss in a duct branch is a function of at least 6 independent variables. Equations are derived on a theoretical and experimental basis, correlating all available data with the aid of 4 experimental curves. Similar formulae can be derived for elbows, diffusers, contracting passages, and other configurations.

532.542.1 1977

Limiting isothermal flow in pipes. BINDER, R. C. *Trans. Amer. Soc. Mech. Engrs*, 66, *pp.* 221–223, *April*, 1944.—An explicit formulation is given for the limiting isothermal flow of a gas in a horizontal pipe. For isothermal flow, the ratio (critical pressure)/(initial pressure) = initial Mach number $\times \sqrt{(C_r/C_0)}$. The critical-pressure ratio for isothermal flow is higher than that for adiabatic flow. Some comparisons are drawn between isothermal, adiabatic and incompressible flow.

532.57 1978

Basic solutions for flow measurement. ZIEBOLZ, H. *Rev. Sci. Instrum.*, 15, *pp.* 80–87, *April*, 1944.—The general energy equation of fluid flow, taking into account energy, pressure, specific volume, velocity of flow, temperature, potential, dissipation and temperature factors, is derived and discussed. The theory is utilized to discuss the design of flow-meters of the orifice-plate, rotameter, variable-orifice, Pitot and Prandtl tubes, Venturi nozzle, hot-wire, thermometric, dilution, proportional-flow and flow-deviation types. J. S. G. T.

532.595 = 3 1979

Water hammer. SCHNYDER, O. *Bull. Ass. Suisse Élect.*, 34, *pp.* 576–578, *Sept.* 22, 1943.—Methods of overcoming water hammer in supply pipes are described and illustrated. W. A. R.

532.612.08 1980

The measurement of surface tension by means of sessile drops. TAYLOR, H. J., AND ALEXANDER, J. *Proc. Indian Acad. Sci. A*, 19, *pp.* 149–157, *March*, 1944.—Apparatus is described by means of which sessile drops can be formed on the upper end of a vertical tube. The drops can be renewed as frequently as desired. Photographs of the drops are measured and from the dimensions the surface tension is calculated with the help of a new reduction table given. The method in this form is considered to be as reliable as any of the other standard methods. It has been applied to measure the surface tension of pure water against saturated air. The value at 20°C. is (72·70 ± 0·07) dyn./cm. in agreement with other determinations.

532.69 1981

The formation of bubbles. DEAN, R. B. *J. Appl. Phys.*, 15, *pp.* 446–451, *May*, 1944.—Extreme values for the neg. pressures and the degrees of superheat which water will withstand without forming bubbles are contrasted with the ease of forming bubbles by vibration or by turbulent flow. The subject of bubble nuclei is reviewed; such nuclei usually function by virtue of sorbed or trapped air which can be removed, rendering the nuclei ineffective. Methods of avoiding extraneous bubble nuclei are given, with some experiments on the formation of bubbles by mechanical action. Free vortices in liquids produce sufficient tension to rupture the liquid, and mechanical disturbance produces bubbles only in such vortices.

532.691 : 541.183 : 531.72 = 3 *see Abstr.* 1966

532.712 : 532.13 : 541.24 *see Abstr.* 2087

532.712 : 541.24 1982

Osmotic pressure of high polymer solutions and molecular weight. HOFF, E. A. W. *Trans. Faraday Soc.*, 40, *pp.* 233–236, *June*, 1944.—Some osmotic measurements with acetyl celluloses and polymethyl-methacrylates are reported.

532.77 : 541.123.2 *see Abstr.* 2083

532.77 : 532.13 = 3 *see Abstr.* 1967, 1968

532.771 : 532.13 = 3 *see Abstr.* 1969

533.5 1983

A convenient type of vacuum chamber for the evaporation of optical films. BANNING, M., AND PAUL, F. W. *Rev. Sci. Instrum.*, 15, *p.* 152, *June*, 1944.

533.6.011 198

A new derivation of Munk's formulae. RANDELS W. C. *Quart. Appl. Math.*, 1, *pp.* 88–92, *April* 1943.—The method of the acceleration potential i used to obtain short proofs of Munk's formulae fo the lift and moment of a thin airfoil. L. S. G

533.6.011.3 198

Concerning the acceleration potential. BERS, L *Quart. Appl. Math.*, 1, *pp.* 93–96, *April*, 1943.—A study is made of the steady incompressible potentia flow past an airfoil of infinite span. The aim is more rigorous approach to Prandtl's method of th acceleration potential for two-dimensional flow. Th boundary-value problem is first formulated rigorousl and then, by a set of simplifying assumptions, a solu tion is obtained. L. S. G

533.662 : 517.5 *see Abstr.* 1936

534.113 : 517.946 : 517.512.2 *see Abstr.* 1939

534.121.1 198

Theoretical analysis of modes of vibration for iso tropic rectangular plates having all surfaces free MCSKIMIN, H. J. *Bell. Syst. Techn. J.*, 23, *pp.* 151 177, *April*, 1944.—Starting with the requirement tha displacements and stresses within the elastic soli must satisfy the conditions of equilibrium as derive from Newton's law, the 3 types of vibration ar analysed in detail. Simplified formulae are derive for the resonant frequencies of long narrow ba vibrating longitudinally, of thin plates with exte sional motion along the thickness dimension, an thin plates vibrating with shearing motion at righ angles to the thickness. Odd-order shears a strongly coupled to even-order flexures, and vic versa. A number of mathematical theorems ar added in explanation of special cases of vibration. G. E. A

534.133 198

Modes of motion in quartz crystals, the effects coupling and methods of design. SYKES, R. A. *Be Syst. Techn. J.*, 23, *pp.* 52–96, *Jan.*, 1944.—The pap presents a physical picture of the manner in whic quartz crystals vibrate in their simplest form whether flexural, extensional or shear, or combinatio of these. Frequency equations are given for th common types of motion; the solutions in certai cases are only to be regarded as guides to the com plete result. The effect of coupling between th various modes is explained, and the types of motio for some standard filter and oscillator plates are illu trated, with their frequency ranges. The gener rules for the dimensions of oscillator plates a presented. An appendix contains a list of the elast and piezo-electric constants for rotation of axes abo the *X*-axis. G. E. A

534.133 : 534.321.9 198

The ultrasonic diffraction grating. HOUSTOU R. A. *Phil. Mag.*, 35, *pp.* 192–202, *March*, 1944.— The uses of a quartz plate as a grating are describe When placed in a periodic electric field, the pla becomes a piezo-electric oscillator in which stationa ultrasonic waves are formed. These cause the r fractive index of the quartz to vary harmonically i the direction of travel of the wave, a rarefactio diminishing the index and a condensation increasi

it. Light is passed through the quartz at right angles to the direction of the ultrasonic waves, i.e. in the length direction of the crystal, and a spectrum is produced. In one case the 475th harmonic was employed, and was equivalent to a grating of 475 rulings. The quartz may be used (*a*) as a grating, (*b*) as a means of measuring the velocity of light, (*c*) as an electric wave-meter, and (*d*) as a means of measuring the persistence of luminosity of an atom. G. E. A.

534.133 : 621.39 1989

Principles of mounting quartz plates. SYKES, R. A. *Bell Syst. Techn. J.*, 23, *pp.* 178–189, *April*, 1944.—Considerations governing the design of holders of quartz crystals are dealt with. The pressure mounting is used for extensional crystals of the — 18 deg. *X*-cut type for frequency range 60 to 150 kc./s. The cantilever type gives low mechanical impedance at or near the operating frequency of the crystal. Wire-supported crystals have certain advantages and details of this type of mounting are given. In the air-gap mounting the plate is held between 2 flat electrodes with flat feet at the corners. This type is of most use for oscillator crystals of the AT and BT types. Development of the 3 types for telephone and radio applications has led to many different forms. G. E. A.

534.231.3 : 621.3.012.8 1990

Notes on radiation impedance. BAUER, B. B. *J. Acoust. Soc. Amer.*, 15, *pp.* 223–224, *April*, 1944.—The electrical-circuit analysis of acoustical meshes involving radiation impedance is complicated by the fact that radiation resistance and inertance terms in the usual form, $R + jX$, vary with the frequency. This objection is overcome by using the equivalent parallel mesh which has approx. const. circuit parameters. The impedance of a pulsating spherical source is taken to exemplify the method, and the analogy may be extended to other radiators. G. E. A.

534.321.9 : 534.133 *see Abstr.* 1988

534.84 = 3 1991

Film studios Bellerive A.G. and synchronization studio Pekafilm A.G., Zürich. DÜRR, O., AND FONTANEL, A. *Schweiz. Bauztg*, 120, *pp.* 289–292, *Dec.* 12, 1942.—A detailed description of two halls converted, one into a film studio, and the other also but with the addition of a synchronization atelier in which speech, music and noises can be added to silent films. The prevention of outdoor noises from penetrating, the attainment of a suitable reverberation time and other arrangements necessary for the efficient production of films, were undertaken. G. E. A.

534.845 = 3 1992

A new method of estimating sound-damping, especially in light structures. FURRER, W. *Schweiz. Bauztg*, 121, *pp.* 39–41, *Jan.* 23, 1943.—Measurements of sound absorption by an ordinary door, 2 simple walls, double and triple light walls, were made. These gave a planimetric mean absorption varying from 24 db for the door to 39 db for the triple wall. The estimation of the intelligibility of speech as employed in telephone practice leads to a similar technique in gauging sound-deafening, and a graph shows the reduction in the intelligibility of syllables with the increase of sound deafening in db. G. E. A.

535.14 : 537.59 1993

Scattering of charged mesons under the influence of radiation damping. MA, S. T., AND HSÜEH, C. F. *Proc. Camb. Phil. Soc.*, 40, *pp.* 167–172, *June*, 1944.—The integral equation which determines the scattering is derived by the method of perturbation of stationary states, which is more conventional than the methods used by previous authors [Abstr. 2401, 2402 (1941)]. The previous theoretical treatment of the scattering of charged vector mesons by nuclear particles through the nuclear interaction is extended to pseudoscalar mesons. Formulae are derived for the differential and total cross-sections for the scattering processes and numerical results calculated from these are given. From these it is evident that the preponderance of scattered mesons in the forward direction increases with the energy of the incident mesons. L. S. G.

535.2 : 535.62 1994

Physical concepts: radiant energy and its measurement. *J. Opt. Soc. Amer.*, 34, *pp.* 183–218, *April*, 1944.—The fifth chapter of the Report of the O.S.A. Committee on Colorimetry [see Abstr. 387 (1944)]. Defines the quantities and units employed in specifying radiant energy and the capacities of materials to radiate, modify and detect radiant energy. Turbid media, polarizing and optically active media, are dealt with. Thermal radiation and associated matters are treated. Radiometry (including photometry and spectrophotometry) occupies the second half of the chapter and descriptions of methods and instruments used are included. J. W. T. W.

535.215 : 537.525.8 *see Abstr.* 2049

535.242.63 : 621.327.44 1995

Filters to colour-match tungsten filament lamps with sodium-vapour lamps. HARDING, H. G. W. *Trans. Illum. Engng Soc.*, 9, *pp.* 89–92, *May*, 1944.—Describes four filters suitable for measuring sodium vapour lamps with tungsten filament sub-standards. One in particular, a combination of 2 glasses, Chance OB2 and Chance OY1, gives spectral transmission with a marked peak at about 590 mμ and a colour quality very close to that of the sodium lamp when the filter is used with a source of colour temperature 2 848°K. The percentage transmission is 8%. J. W. T. W.

535.243 : 621.317.39 1996

A non-recording microphotometer with variable contrast sensitivity. RYMER, T. B., AND BUTLER, C. C. *Phil. Mag.*, 35, *pp.* 202–209, *March*, 1944.—Describes a microphotometer designed especially for measuring the positions of broad lines on a spectrograph. For the ordinary purpose of measuring intensities, the electrical circuits are adjusted to give a linear response, but for the determination of position (to 1 μ) of a broad line, the constants are adjusted so that the peak of the line is greatly exaggerated. J. W. T. W.

535.245.1 1997

Illumination conversion chart for inclined work planes. FRANCK, K. *Illum. Engng, N.Y.*, 39, *pp.* 245–252, *April*, 1944.—A nomograph is given for determining the ratio of the illumination on an inclined plane to that on a horizontal plane at the same point, given (*a*) the horizontal and vertical distances (*h* and *d*) of the source to the test plane, measured in the vertical plane normal to the test plane, and (*b*) the

angle of slope of the test plane (i). In effect the nomograph evaluates $\cos i + (d/h) \sin i$. J. W. T. W.

535.247.4 : 621.316.8 1998

An improved "zero-resistance" circuit for photocell photometry. PROJECTOR, T. H., LAUFER, M. K., AND DOUGLAS, C. A. *Rev. Sci. Instrum.*, 15, *p.* 107, *April*, 1944.—The original circuit [Abstr. 244 (1941)] has been modified to improve maintenance of calibration and to facilitate measurements under adverse conditions. A circuit diagram of the improved circuit is given.

535.317.1 1999

Direct methods in geometrical optics. HERZBERGER, M. *Trans. Amer. Math. Soc.*, 53, *pp.* 218–229, *March*, 1943.—A method is developed giving the image co-ordinates (in an axially symmetric optical system) as functions of the object co-ordinates by a series of matrix transformations. After an exposition of the general theory some important special cases are discussed. The first type of image formation is given by $B \equiv 0$ [Abstr. 2000]. This type is produced by a single sphere or a concentric lens system. A system giving a sharp image of one plane $Z = 0$ upon another $Z' = 0$ would be given by $A = \text{const.}$, which leads to the result

$$\begin{pmatrix} x' \\ \xi' \end{pmatrix} = M_0 \begin{pmatrix} x \\ \xi \end{pmatrix}, \quad \begin{pmatrix} y' \\ \eta' \end{pmatrix} = M_0 \begin{pmatrix} y \\ \eta \end{pmatrix}$$

where $M_0 \equiv \begin{pmatrix} A_0 & 0 \\ C(u_1) & 1/A_0 \end{pmatrix}$. This is a generalization of the sine condition of Abbe, A_0 being the magnification. The single spherical surface is studied and some transition formulae are given for tracing a system of rays through a system of centred lenses. The paper concludes with a brief sketch of image error theory. L. S. G.

535.317.6 2000

A direct image error theory. HERZBERGER, M. *Quart. Appl. Math.*, 1, *pp.* 69–77, *April*, 1943.—In an axially symmetric system let (x, y, z) and (x', y', z') be Cartesian co-ordinates in the object and image spaces. A ray is given by the co-ordinates x, y (or x', y') of its intersection with the plane $z = 0$ (or $z' = 0$) and the optical direction cosines are ξ, η, ζ (or ξ', η', ζ') where $\xi^2 + \eta^2 + \zeta^2 = n^2$, $\xi'^2 + \eta'^2 + \zeta'^2 = n'^2$ and n and n' are the refractive indices. The problem is to find x', y', ξ', η' when x, y, ξ, η are given. Four functions A, B, C, D exist such that

$$\begin{pmatrix} x' \\ \xi' \end{pmatrix} = M \begin{pmatrix} x \\ \xi \end{pmatrix}, \quad \begin{pmatrix} y' \\ \eta' \end{pmatrix} = M \begin{pmatrix} y \\ \eta \end{pmatrix}$$

where $M = \begin{pmatrix} A & B \\ C & D \end{pmatrix}$; and A, B, C, D depend only on the three symmetric functions $u_1 = (x^2 + y^2)/2$, $u_2 = x\xi + y\eta$, $u_3 = (\xi^2 + \eta^2)/2$, and satisfy $|M| = 1$ and three differential equations. These three equations are used to develop the theory of image errors. After a short section on Gaussian optics, the third-order and fifth-order error theory is developed. The paper concludes with applications to the single sphere and the plane and in the former case the seventh-order image-error coefficients are given. L. S. G.

535.324 : 532.14 : 547.599.6 2001

Determination of camphor and alcohol in spirit of camphor by refractive index and specific gravity. PLEIN, E. M., AND POE, C. F. *Industr. Engng Chem.*, 16, *pp.* 168–169, *March* 15, 1944.—A chart is given from which the percentages of alcohol and camphor in spirit of camphor may be determined when the refr. index and sp. g. of the spirit are known. Analyses of different samples of spirit of camphor agree with the theoretical values.

535.324 : 547.458.6 2002

Refractive-index/dry-substance tables for starch conversion products. CLELAND, J. E., EVANS, J. W., FAUSER, E. E., AND FETZER, W. R. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *pp.* 161–165, *March* 15, 1944.—The refr. index of starch hydrolysate syrups measures their dry-substance content, provided the ash and dextrose equivalent are known. The temperature correction, above 14% dry substance, is linear. The precision of this method is the precision of a 4-place refractometer. Tables are presented covering refractive-index/dry-substance for the usual commercial products from 0 to 90% dry substance, and refractive-index/commercial-Baumé.

535.338.3 : 539.133 2003

Magnetic-dipole transitions in the configurations $5p^5$, $5p^4$, and $6p^5$ of xenon and radon. EDLÉN, B. *Phys. Rev.*, 65, *p.* 248, *April* 1 *and* 15, 1944.

535.338.3 : 539.153.4 2004

Newton's theorem of revolving orbits and the theory of fine structure of spectral lines. DUBE, G. P., AND JHA, S. *Bull. Patna Sci. Coll., No.* 14, *pp.* 118–124, *Jan.*, 1944.—The rotating ellipse of Sommerfeld's relativistic theory of motion of an electron round a pos. charged nucleus is considered. Classically, the relativity effect can be interpreted as a central-force perturbation. Using this force combined with the Coulomb force, the Schrödinger equation is solved and the energy levels are obtained. The result differs from the accepted result by a term containing the factor $3/4$. The cause of this discrepancy is investigated, and it is concluded that in atomic problems the relativity effects cannot be regarded as due to an equivalent central-force perturbation.

535.338.4 : 546.17 2005

Note on the spectrum N_2. WORLEY, R. E. *Phys. Rev.*, 65, *p.* 249, *April* 1 *and* 15, 1944.

535.338.4 : 546.172.6 2006

Development of δ and γ bands of nitric oxide in active nitrogen and Lyman bands in helium-nitrogen mixture. ANAND, B. M. *Indian J. Phys.*, 17, *pp.* 246–251, *Oct.*, 1943.—The doublet structure of 0-0, 0-1, 0-2 and 0-3 bands of the δ system of NO as observed in active N_2 by a 1 m. normal-incidence vacuum spectrograph is described. The vibrational structure of 1,0 and 2,0 bands of γ system was measured. Whereas δ and γ band systems are prominently present, β bands of NO (in the vacuum region) are particularly absent in the afterglow. Lyman–Birge–Hopfield bands of N_2 were developed in a mixture of He and N_2. Three new bands of the system are reported.

535.338.42 : 539.13 *see Abstr.* 2061

535.343.2-1 : 548.0 : 535.375.5 *see Abstr.* 2012

535.37 2007

A theory of concentrational quenching of fluorescence in solutions. WAWILOV, S. I. *C.R. Acad. Sci. URSS*, 35, 4, *pp.* 100–106, 1942.—The limitations

of earlier theories to account for the decrease in fluorescence yield L with increase in conc. c are indicated. The relationship between L and c is expressed in terms of the various constants which characterize the phenomenon and which may be determined from measurements. Theoretical and experimental values are compared, using the results of measurements carried out by other authors on solutions of fluoresceine, rhodamine and eosine, respectively, in glycerine. A. E. T.

535.371 2008

Phosphors versus the periodic system of the elements. Leverenz, H. W. *Proc. Inst. Radio Engrs, N.Y.*, 32, *pp.* 256–263, *May*, 1944.—The properties of a number of well-known inorganic phosphors are described as function of variations of their constituents. Chemical substitutions made according to the ordered series in the periodic system of the elements produce anomalous energy changes which appear as shifts in the spectral emission colours of phosphors. The mechanisms of luminescence in solids cannot be given a simple interpretation. The relative cathodo-luminescences of 45 phosphors are codified and presented in tabular form.

535.371 : 544.65 2009

Fluorescence reactions with boric acid and o-hydroxy-carbonyl compounds, and their application in analytical chemistry. II. Detection of **in aromatic compounds containing C, H and O only.** Neelakantam, K., Row, L. R., and Venkateswarlu, V. *Proc. Indian Acad. Sci. A*, 18, *pp.* 364–372, *Dec.*, 1943.—[See Abstr. 1061 (1943)]. Addition of H_3BO_3 to aromatic compounds, dissolved in conc. H_2SO_4 produces intensification or change in colour of the fluorescence exhibited by them in daylight or under the lamp. In several cases the solution of the compound is itself non-fluorescent. The fluorescence effects could be utilized for the detection of the group in aromatic compounds containing C, H and O only. A positive reaction indicates the presence of this group, but the converse is not true.

535.372 2010

Fluorescence spectrum of uranyl fluoride. Pant, D. D., and Sakhwalkar, N. D. *Proc. Indian Acad. Sci. A*, 19, *pp.* 135–140, *March*, 1944.—The spectrum was studied at liquid-air temperature. The spectrum which consists of 17 sharp and discrete bands is classified into 5 groups and 5 series. The bands are interpreted as due to the transitions from (0, 0, 0)′ and (0, 1, 0)′ levels to the various vibrational levels of the ground state. All the three frequencies of the uranyl ion have been taken into account for the interpretation.

535.372 2011

Cross-prism investigation of fluorescence. Germann, F. E. E., and Woodriff, R. *Rev. Sci. Instrum.*, 15, *pp.* 145–149, *June*, 1944.—A cross-prism method is described whereby a single photograph of a fluorescence spectrum gives directly both intensity and spectral distribution of light brought about by light of all wavelengths used as exciting light. A vertical scanning of such a photograph gives the variation of light intensity of a given wavelength as a function of the exciting wavelength. A horizontal scanning gives the spectral energy distribution as a function of wavelength for a given frequency of exciting light. Using a continuous source of ultra-violet radiation, a single exposure thus gives all information necessary to determine the best frequencies of exciting light to produce a max. fluorescent light of a given colour or energy distribution.

535.375.5 : 535.343.2-1 : 548.0 2012

Raman effect in relation to crystal structure: sodium nitrate. Rao, B. S. R. *Proc. Indian Acad. Sci. A*, 19, *pp.* 93–99, *Feb.*, 1944.—By adopting a set of 7 constants, 4 of which pertain to the forces in the free ion and the remaining 3 to the inter-ionic forces in the crystal, the observed Raman and infra-red spectra of $NaNO_3$ crystal are explained.

535.375.5 : 541.57 2013

Raman effect and hydrogen bonds. IX. Solutions of salicylic acid and aspirin. Murty, G. V. L. N., and Seshadri, T. R. *Proc. Indian Acad. Sci. A*, 19, *pp.* 17–20, *Jan.*, 1944.—[See Abstr. 1941 (1943)]. The Raman spectrum of salicylic acid was studied in dioxane and benzene solutions. In the former, monomolecular chelate structures associated with the solvent predominate; in the latter, some chelate monomers exist, but the major portion consists of dimers whose structure is not quite clear. The spectrum of acetyl salicylic acid (aspirin) in dioxane indicates that it has a chelate structure.

535.375.51 2014

Raman spectra of acetylenic bromides, iodides, and ketones and of some cyclic compounds. Murray, M. J., and Cleveland, F. F. *J. Chem. Phys.*, 12, *pp.* 156–166, *May*, 1944.—Raman spectra are listed for series of acetylenic bromides, iodides and ketones, and for ascaridole, 1,3-dioxane, ethyl-*p*-toluenesulphonate, and for the *cis*- and *trans*-1,2-diacetoxycyclohexanes. Depolarization factors (when obtained) and rel. intensities were measured by a Gaertner microdensitometer.

535.375.51 2015

Raman spectra of hexachloroethane and hexabromoethane. Hamilton, D. T., and Cleveland, F. F. *J. Chem. Phys.*, 12, *pp.* 249–252, *June*, 1944.—The rel. intensities and depolarization factors were obtained by use of a Gaertner microdensitometer. The fundamental frequencies of hexachloroethane were used to calculate force constants from the equations used by Stitt for ethane. The Raman data indicate that the equilibrium configuration for hexachloroethane is that corresp. to the point group D_{3d}. The force constants were used to calculate the values of the frequencies allowed by the selection rules in the infra-red spectrum. Selection rules for the fundamentals, binary combinations, overtones of non-degenerate frequencies, and overtones of degenerate frequencies up to the fourth overtone for any molecule whose symmetry is D_{3h}, D'_{3h}, or D_{3d} were worked out and are discussed.

535.375.55 2016

Effect of temperature on the intensities of Raman lines. III. Liquids. Venkateswarlu, K. *Proc. Indian Acad. Sci. A*, 19, *pp.* 111–116, *Feb.*, 1944.—[See Abstr. 126 (1943)]. The effect was studied in CCl_4,

benzene, normal butyl alcohol and chlorobenzene. The Stokes lines in all cases, except at 215 cm.$^{-1}$ in CCl_4, decrease in intensity with increase of temperature whereas the anti-Stokes lines increase in intensity but not to the expected extent. The ratio of the intensities of the Stokes and anti-Stokes lines agrees with the calculated value. The intensities of the Stokes lines, after applying the correction for the change in density on the assumption that the number of effective scattering centres will be $\propto$ (density)$^{-1}$ are not equal to the calculated values.

535.379 2017

Comparative study of photoluminescence in liquid and solid solutions of thallium salts. KONDILENKO, I. I., AND SHISHLOVSKY, A. A. *C.R. Acad. Sci. URSS*, 35, 6, *pp.* 163–166, 1942.—Describes spectral investigations of aqueous solutions of the haloids and sulphate of Tl, particularly to observe the effect of concentration of foreign ions in the solution. The data obtained were compared with available spectral data for crystalline Tl luminophores. The principal conclusion arrived at is that in the solid, as well as in the liquid solution, the cation Tl^+ is the carrier of luminescence. A. E. T.

535.393 : 535.51 2018

Some properties of metals studied by reflected polarized light. CHATTERJEE, L. M., AND PRASAD, K. N. *Bull. Patna Sci. Coll., No.* 14, *pp.* 125–131, *Jan.*, 1944.—Characteristics of elliptically polarized light reflected from polished metal surfaces are studied; values of absorption coeff. of Au, Cu and Pt, for different wavelengths, are measured and discussed. The positions of absorption bands for Cu and Au are determined by plotting the difference of the squares of the refr. index and of the extinction coeff. against wavelength. In the case of Au, the curve obtained here and curves obtained by plotting the data of previous workers, intersect at 5 200 Å, which is interpreted as the centre of the absorption band.

535.393 : 537.29 *see Abstr.* 2045

535.417 : 620.164 2019

An interferometer for controlling large mechanical details. LINNIK, V. P. *C.R. Acad. Sci. URSS*, 35, 1, *pp.* 16–19, 1942.—Describes an interferometer for the examination of long surfaces of linear nature (plane, cylindrical) for departures from rectilinearity. As compared with a previous arrangement described by the author in the same journal (32, 3, 1941), the present scheme is free from the drawbacks associated with aberrations due to superficial irregularities. As an example, the interference pattern obtained from a plate of mirror-glass 400 mm. long is reproduced. A. E. T.

535.43 : 548.55 2020

Scattering of light in single crystals. BHAGAVANTAM, S., AND VENKATESWARLU, K. *Proc. Indian Acad. Sci. A*, 19, *pp.* 108–110, *Feb.*, 1944.—Employing CCl_4 as an intermediate standard, the rel. intensities of Rayleigh and Raman lines in specially cut crystals of calcite and quartz were determined for different orientations. The Rayleigh line possesses an intensity which is only about 2 to 7 times that of the principal Raman line.

535.433 2021

Diffraction coronae due to non-spherical particles. RAMACHANDRAN, G. N. *Proc. Indian Acad. Sci. A*, 19, *pp.* 123–130, *March*, 1944.—The Fraunhofer diffraction due to an obstacle of arbitrary shape can be replaced by that given by a linear distribution of sources along its boundary. Most of the intensity at any point in the pattern can again be supposed to originate from a finite number (2) of point sources situated on the boundary. If there are a large number of non-spherical particles distributed at random, a ring system will be formed whose size will correspond to the distance between opposed points. If this distance is a const. over an appreciable region of the boundary, the rings will stand out from the background intensity. This explanation of the formation of the rings, has been verified using spores of *Pinus longifolia* and of *Lycopodium*. Variations in the size of the particles affect the clarity of the rings.

535.51 : 535.393 *see Abstr.* 2018

535.6 : 7.01 2022

Aesthetic measure applied to colour harmony. MOON, P., AND SPENCER, D. E. *J. Opt. Soc. Amer.*, 34, *pp.* 234–242, *April*, 1944.—A continuation of previous work on colour harmony [Abstr. 1099, 1100 (1944)], an attempt being made to assess colour combinations quantitatively on a scale of aesthetic merit, using Birkhoff's measure, viz. the ratio of the weighted sum of the elements of order to the number of elements of complexity. J. W. T. W.

535.62 : 535.2 *see Abstr.* 1994

535.8 2023

Graticules. SMETHURST, P. C. *Photogr. J.*, 84, *pp.* 147–151, *May*, 1944.—Describes the various methods of producing graticules and gives full details concerning the use of lead sulphide mirrors. Apart from general considerations of graticule production, data are given concerning the actual photographic work involved, including focusing, type of plate, exposure, etc. The production of master drawings is discussed as are also a number of manufacturing problems. A. H.

535.87 : 654.91 2024

Emergency signalling mirror incorporating high efficiency with precision aiming. POTTER, W. M. *Illum. Engng, N.Y.*, 39, *pp.* 253–258, *April*, 1944. *Gen. Elect. Rev.*, 47, *pp.* 7–9, *May*, 1944.—A 4 × 3 in. plate of glass carries a thin film of vaporized Al of high reflectivity. In the centre is a clear aperture in the form of a cross. In use, the mirror is held a few inches from the eye and in about the right position for reflecting the sun's rays on to the rescuer whose attention it is desired to attract. The sun shining through the cross should be intercepted by part of the person. The mirror is then tilted until the image (seen in the back of the mirror) of the bright cross-like patch so formed is lined with the aperture and with the rescuer. The reflection from the front of the mirror will then be directed at the rescuer. J. W. T. W.

536.2.01 = 3 2025

Theory of similitude of heat exchangers. TRAUPEL, W. *Schweiz. Arch. angew. Wiss. Techn.*, 10, *pp.* 33–39, *Feb.*, 1944.—The theory of similitude is useful in

correlating heat transfer data, but gives the results in terms of dimensionless groups of variables. The paper shows how the method can be extended to give values for the actual heat transfer coefficients which are required when designing tubular heat interchangers for either parallel or transverse flow.

R. W. P.

536.2.01 = 3 2026

Progress and problems in heat transfer. BOSCH, M. TEN. *Schweiz. Bauztg*, 121, *pp.* 197–200, *April* 17, 1943.—A brief review of some recent contributions to the theory of heat transfer. The subjects dealt with include absorption of radiation by water vapour and CO_2, heat transfer for turbulent air flow (*a*) over a streamlined surface, (*b*) through tubes and (*c*) over non-streamlined bodies. R. W. P.

536.2.02 2027

Some problems involving line sources in conduction of heat. JAEGER, J. C. *Phil. Mag.*, 35, *pp.* 169–179, *March*, 1944.—Two problems in heat conduction are considered which can be solved in cylindrical coordinates by the Laplace transform method because of the special form of this transformation of the temperature due to a line source. These are (1) the temperature due to a line source parallel to the axis of a composite solid of which the region $r < a$ is of one substance and $r > a$ is of another, and (2) the temperature of a circular cylinder round whose surface a line source moves with const. angular velocity. The latter case arises in practice when a rotating cylinder is frictionally heated on a portion of its surface. Variations of this problem are also discussed. R. W. P.

536.21 : 537.312.6 *see Abstr.* 2047

536.21 = 3 2028

On the thermal efficiency of external walls. WEBER, A. P. *Schweiz. Bauztg*, 123, *pp.* 113–114, *March* 4, 1944.—Refers to a paper of van der Held's (*Ges. Ing.*, No. 19, 1943) which correlates cost of wall insulation with thermal efficiency. The equations quoted are, $k_w = (pK\lambda/JG_h)^{1/2}$ and $J = Q' + pQ(t_i - t_a)/100G_h$, where k_w = heat transmission coeff. in kcal./h.m.² °C., λ = the thermal conductivity of wall or insulating material in kcal./h.m.°C., K = cost of material Fr/m.³, J = price of heating, allowing for plant depreciation, in Fr/kcal., p = amortization in %, G_h = No. of heating hours per year, t_i = room temperature °C., t_a = mean external temperature, Q = cost of plant Rp/kcal.h. and Q' = cost of fuel in Rp/kcal. Examples are given. R. W. P.

536.25 2029

Thermal repulsion. PARANJAPE, M. K. *Curr. Sci.*, 13, *pp.* 72–73, *March*, 1944.—Describes a simple set-up for studying the phenomenon of thermal repulsion induced by a temperature gradient operating across an air gap which is too narrow for convection to be appreciable. It is found that the thermal force for a temperature difference of 1°C. attains a sharp max. value of the order of 0·027 dyne/cm.², when the air pressure is about 10^{-2} cm. of Hg. R. W. P.

536.4 : 541.127.3 : 676 2030

Gases evolved by the thermal decomposition of paper. MURPHY, E. J. *Trans. Electrochem. Soc.*, 83, *pp.* 161–174, 1943.—Curves are given to show the rate of evolution of gas by the thermal decomposition of paper as a function of time, and the dependence of rate upon temperature. The temp. dependence of the rate agrees with the Arrhenius formula for reaction velocities. The thermal decomposition reaction has 2 activation energies, one (33 500 cal.) applying to the initial condition and the other (39 500 cal.) to a condition reached after protracted heating. The gases evolved consist of H_2O, CO_2 and CO. The CO_2 and CO coming off in association with H_2O provide a means of recognizing an end point in the drying operation. When the ratios of these constituents become const., the paper may be considered to be as dry as possible at the temperature prevailing, without change of its composition. Curves are given to show what degree of correlation exists between the temperature dependence of the ageing process, as expressed in changes of tensile or folding strength, and the temperature dependence of rate of gas evolution.

536.413.2 : 625.14 = 3 2031

On the theory of rail expansion. STÜSSI, F. *Schweiz. Bauztg*, 121, *pp.* 231–232, *May* 8, 1943.—[Abstr. 1573 B (1944)].

536.421 2032

The melting of crystalline polymers. FRITH, E. M., AND TUCKETT, R. F. *Trans. Faraday Soc.*, 40, *pp.* 251–260, *June*, 1944.—The thermodynamic equilibrium betw. crystalline and amorphous polymeric phases is discussed in terms of a fringed micelle model, as indicated by X-ray data. An expression derived for the m.p. of a crystalline polymer depends on the proportion θ of amorphous material in the structure: this unsharp m.p. depends ultimately on a non-linear rel. betw. θ and the free energy of the system. Calculated values of the crystalline amorphous equilibrium ratio over a range of temperature agree with experimental data. An attempt is made to extend the calculations to stretched polymers; qualitative agreement is found.

536.421.4 : 541.183.25 2033

The freezing points of adsorbed liquids. BATCHELOR, R. W., AND FOSTER, A. G. *Trans. Faraday Soc.*, 40, *pp.* 300–305, *July-Aug.*, 1944.—Examination of the v.p./temperature curves shows that dioxane adsorbed on ferric oxide gel of pore radius approx. 100 Å melts sharply about 6°C. below the normal m.p. Water adsorbed on silica gel of pore radius approx. 11 Å remains liquid even on cooling to − 65°C. A theoretical expression for the lowering of m.p. is given.

536.421.4 : 578.088.6 2034

Machine for shell-freezing small volumes of biological preparations. ANTOINE, L. D., AND HARGETT, M. V. *J. Bact.*, 46, *pp.* 525–529, *Dec.*, 1943.—One operation in the desiccation method of preserving certain biological preparations such as yellow-fever vaccine, requires that it be frozen rapidly in the form of a thin-walled hollow cylinder. The electrically operated machine is described; employing CO_2 ice as the refrigerant and ethyl alcohol as the circulation medium, it accomplishes this effectively and rapidly with only a single operator. C. J. G.

536.495 : 539.4.01 = 3 *see Abstr.* 2077

536.633 : 662.753 2035

The specific heat of 100-octane fuel in the gaseous state. SPIERS, H. M. *J. Inst. Fuel*, 17, *p.* 130, *April*, 1944.—Values are derived for the sp. ht. of 100-octane fuel from a consideration of its approx. composition and from existing data for the sp. hts. of paraffins, naphthalenes and aromatic hydrocarbons. For the gaseous form, the derived values of C_p at 0° and 100°C. are 0·350 and 0·443, and for C_v 0·329 and 0·423 cal./g./°C.

536.662 : 662.753 2036

Operating procedure for determining the heat of combustion of gasoline. DEAN, E. W., WILLIAMS, A. A., AND FISHER, N. E. *Industr. Engng Chem. (Analyt. Edit.)*, 16, *pp.* 182–184, *March* 15, 1944.

536.666 2037

The heat of formation of oleum. MILES, F. D., NIBLOCK, H., AND SMITH, D. *Trans. Faraday Soc.*, 40, *pp.* 281–295, *July-Aug.*, 1944.—The differential heats of addition of liq. SO_3 to fuming H_2SO_4 containing 70% of free SO_3 were determined. In one method the heat required to evaporate the SO_3 from the oleum was supplied and measured as electrical energy, and in the other, liq. SO_3 was prepared and added to excess of oleum, the rise of temperature being measured. The sp. hts. of oleums in this range were measured. The heats of evaporation in the first series of experiments were higher than those given by adding the lat. ht. of vaporization of SO_3 to the heats of addition determined for liq. SO_3 not specially dried. There is a sudden fall in the differential heat of solution when the conc. of free SO_3 in the oleum reaches 45%. A redetermination of the heat of combination of liq. SO_3 and H_2O was made by adding liq. SO_3 to 96% H_2SO_4 and using the data of Brønsted to find the change in heat content of the acid. The result is 20 000 cal./mol. From the exp. data the integral heats for oleum are derived and placed on a common basis with Brønsted's data for H_2SO_4.

536.7 2038

The virtue of energy, its meaning and practical significance. THRING, M. W. *J. Inst. Fuel*, 17, *pp.* 116–123, *April*, 1944.—A proposal is made for a practical way of assessing the value of energy, as that fraction of it which could be converted into useful work. This quantity is called the virtue of energy. If measured in ft. lb. units, 1 B.Th.U. of electricity would have virtue J ft. lb. ($J = 778$) but 1 B.Th.U. of heat at temperature T°F. would have virtue $J(1 - T_1/T)$ ft. lb. where T_1 is the temperature of the surroundings. The second law of thermodynamics can be expressed in the simple form "the virtue of all the energy taking part in any process must decrease or remain const." The new concept thus enables the second law to be used to assess the degradation of energy that takes place. This can be done in a diagram where energy is plotted against the reciprocal of the abs. temperature. The virtue loss, irreversibility, or degradation of energy is shown as a decrease in area under the curve. Applications of such diagrams to processes of industrial heating, combustion, direct heat transfer and to a complete heat-engine cycle, are given, and general conclusions are drawn regarding the efficiency of various processes, and ways in which fuel economies can be effected.

R. W. P.

536.71 : 539.31 : 548.0 2039

The thermodynamics of crystal lattices. IV. The elastic constants of a face-centred cubic lattice with central forces. GOW, M. M. *Proc. Camb. Phil. Soc.*, 40, *pp.* 151–166, *June*, 1944.—Using the results of the preceding paper [Abstr. 1460 (1943)], the 3 elastic constants of a monatomic face-centred cubic lattice are determined as functions of pressure and temperature, assuming central forces between the particles and a potential $\phi = \frac{umn}{n-m}[(r_0/r)^n/n - (r_0/r)^m/m]$ where u is the dissociation energy and r_0 is the equilibrium distance. Numerical calculations are carried out for five pairs of values of (m, n), namely (4, 8); (5, 10); (6, 12); (6, 14); (7, 14), and the results are presented in tabular and graphical form. The assumption of central forces is not always accurately satisfied (e.g. in the case of metals) but the calculations allow deviations of experiments from the theoretical results to be used as indications of the non-central character of the forces. The results are discussed and compared with previous computations [see Abstr. 4095 (1939)].

L. S. G.

536.717 = 3 2040

On reversible cyclic processes having maximum thermal efficiency. GREINACHER, H. *Helv. Phys. Acta*, 17, 2, *pp.* 133–138, 1944.—Other thermal cycles are considered which are shown to have the same max. thermal eff. as the Carnot cycle. R. W. P.

536.73 = 4 2041

Maxwell's demons and the second law of thermodynamics. DEMERS, P. *Canad. J., Res. A*, 22, *pp.* 27–51, *March*, 1944.—A difficulty which confronted the 2nd law of thermodynamics was overcome by the introduction of Maxwell's demons. This has not been entirely resolved and the subject is reviewed once more. An alternative solution is suggested, which is based on the existence of black-body radiation and on the quantum nature of the emission. The 2nd law is re-enunciated as "a system at one temperature only cannot produce useful work." R. W. P.

536.77 : 541.123.2.034.6 2042

The free energies of solutions of single and multiple molecules. ORR, W. J. C. *Trans. Faraday Soc.*, 40, *pp.* 320–332, *July-Aug.*, 1944.—Explicit expressions for the free energies, heats and entropies of mixing of single and multiple molecules in terms of the rel. numbers of molecules present, the heat of mixing, the co-ordination number and the temperature, are derived on the basis of the statistical model of the strictly regular solution. In a critical examination of the probable limits of validity of the formulae obtained, it is shown that, while the method provides an exact evaluation of the average properties of a mixture of 2- or 3-group molecules with single molecules at low conc. of the multiple molecule, which however becomes less exact at high conc., in the general case of the n-group molecule (where $n > 3$), the result obtained is an approximation at all conc. The theoretical calculations are compared with the available thermodynamic data on the rubber-benzene system. [See Abstr. 1420 (1937), 114 (1939), 1507 (1942), 2083 (1944)].

537.1 : 530.12 *see Abstr.* 1957

537.1 : 531,51 : 530.12 *see Abstr.* 1956

537.226 2043

Dielectric properties of dipolar substances. FRÖHLICH, H., AND SACK, R. *Proc. Roy. Soc. A*, 182, *pp.* 388–403, *June* 16, 1944.—From an investigation of structure it is shown that there exists a large group of dipolar organic solids whose dipoles have 2 equilibrium positions with opposite dipole direction. To calculate the dielectric properties, Onsager's theory is extended and developed into a systematic approximation which converges above a critical temperature. To derive the local field acting on a dipole, the surroundings are replaced by a continuum whose dynamic dielectric properties are taken into account. As a result, larger permittivities and smaller dielectric losses than in Onsager's theory are found. Liquids with high viscosity behave similarly to solids, while for liquids with low viscosity there are no such deviations from Onsager's theory.

537.226.1 2044

Dielectric constants of polar liquids and the dipole moments. SYRKIN, J. K. *C.R. Acad. Sci. URSS*, 35, 2, *pp.* 43–46, 1942.—A formula is derived showing the relation between the effective and ideal orientational polarizations, which in turn has led to a formula from which the dipole moment of a pure polar liquid can be determined if its permittivity, density and refr. index are known. Values of the dipole moment for a number of polar liquids, computed by this formula, are compared with values for dilute solutions in non-polar solvents, as computed from Debye's formula. A. E. T.

537.29 : 535.393 2045

The effect of intense electrostatic fields on the reflectivity of tungsten. STROBEL, C. K. *Phys. Rev.*, 65, *pp.* 283–287, *May* 1 *and* 15, 1944.—The results of a study of the effects of intense electrostatic fields on the reflectivity of W show no detectable change with surface voltage gradients up to about 6×10^6 V/cm. In order to produce observable effects it will be necessary to use much higher surface voltage gradients and a more sensitive detecting means.

537.29 : 541.182.5 2046

Electrical anisotropy of xerogels of hydrophile colloids. I. SHEPPARD, S. E., AND NEWSOME, P. T. *J. Chem. Phys.*, 12, *pp.* 244–248, *June*, 1944.—A number of colloid materials were coated in sheet form and fibred internally by stretching to 100% or more elongation. Circular discs were cut from the fibred sheets, and their degree of orientation measured in an (alternating) electric field. Account is given of the relation of the orientation to field strength, thickness, humidity and moisture content. Induced electrical anisotropy is not shown by organophile xerogels, but only by the hydrophile ones. With most of these the electrical response depends upon the rel. humidity and the absorbed water content, but with polyvinyl alcohol the effect was independent of the absorbed water.

537.312.6 : 536.21 2047

Thermal and electrical conductivity of graphite and carbon at low temperatures. BUERSCHAPER, R. A. *J. Appl. Phys.*, 15, *pp.* 452–454, *May*, 1944.—Thermal and electrical conductivities of graphite and carbon were measured betw. −191° and 100°C. Thermal conductivity of graphite increases at an increasing rate as the temperature is lowered and 2 values were found for Acheson graphite, a longitudinal and transverse conductivity, the latter being about $^1/_2$ the former. The electrical conductivity of graphite increases with rise of temperature as contrasted with the decrease of the thermal conductivity. Carbon shows no anisotropy. The thermal and electrical conductivities both increase with temperature rise, the thermal conductivity linear, in the range −191° to 100°C.

537.363 : 541.132.3 2048

The electrophoretic behaviour of certain hydrocarbons and the influence of temperature thereon. DOUGLAS, H. W. *Trans. Faraday Soc.*, 40, *p.* 344, *July-Aug.*, 1944.—Errata [Abstr. 204 (1944)].

537.525.8 : 535.215 2049

The new light-effect in chlorine under electrical discharge. I. Influence of different irradiations on the production of the phenomenon under constant electrical conditions. DEO, P. G. *Proc. Indian Acad. Sci. A*, 19, *pp.* 117–122, *Feb.*, 1944.—The conductivity of Cl under an electrical discharge is reduced instantaneously and reversibly on irradiation. This effect increases by increasing the frequency and the intensity of light, and the former is the more important factor.

537.533.72 : 621.385.833 = 3 2050

Rigorous calculation of magnetic lenses with a field form $H = H_0/[1 + (z/a)^2]$. GLASER, W. *Z. Phys.*, 117, 5–6, *pp.* 285–315, 1941.—The equation of motion for a paraxial electron is $d^2r/dz^2 + (e/8mU)H^2(z)r = 0$ which, when the form $H(z) = H_0/[1 + (z/a)^2]^\mu$ is assumed, may be written as an equation of Hill's type, $v''(\phi) + J(\phi)v(\phi) = 0$, where $J(\phi) = 1 + K^2 \sin^{4(\mu-1)}\phi$ and $K^2 = eH_0^2a^2/8mU$. The case $\mu = 1$ is studied in detail, the solution in this case being expressible in terms of circular functions. For the focal length f, the expression found is $a/f = \sin(\pi/\sqrt{\{1 + K^2\}})$, which, in the limit as $K \to 0$ agrees with the Busch formula $\frac{1}{f} = (e/8mU)\int_{-\infty}^{\infty} H^2 dz$. Formulae are obtained for the magnification and for the number of intermediate images, the latter occurring in lenses of great power. The image rotation, $\psi = \sqrt{(e/8mU)}\int_{z_0}^{z_1} H dz$ is found to be $\psi = n\pi K/\sqrt{\{1 + K^2\}}$, for the nth image. Expressions are obtained for the chromatic and spherical aberrations. Finally there is a study of the influence of a lack of field symmetry on the optical constants and on the aberration. L. S. G.

537.533.72 : 621.385.833 = 3 2051

Rigorous calculation of magnetic lenses with an unsymmetrical field form after Glaser. DOSSE, J. *Z. Phys.*, 117, 5–6, *pp.* 316–321, 1941.—[See Abstr. 2050 (1944)]. The field is represented in the form given with constants a_1 for $z < 0$ and a_2 for $z > 0$, and the departure from symmetry is measured by $\sigma = a_1/a_2$. Using formulae taken from Glaser's paper, calculations are made of the refractive power and the spherical and chromatic aberrations. For each of these quantities a family of curves (using σ as parameter) is plotted showing the variation with K of the function in question. L. S. G.

537.533.72 : 621.385.833 = 3 2052

On the dioptrics of electron-optical devices with arbitrarily curved image axes. WENDT, G. *Z. Phys.*, 120, 11–12, *pp.* 720–740, 1943.—A mathematical theory is given, in which the curvilinear co-ordinate system is chosen so that the optical axis (w) is the electron path joining the midpoints of the object and image planes, and the u and v directions are along the normal and bi-normal, respectively. The electric and magnetic potentials are expanded into power series in u and v along the axis. Fermat's principle yields the equations of motion and into these are substituted the power series; the expressions are arranged as new power series in u and v. The linear terms permit the calculation of the curvature of the axis, and the second-order terms yield the equations of motion for paraxial electrons. These are a generalization of the equations relating to axially symmetric lenses with a straight axis [Abstr. 5220 (1935)]. With a method of successive approximation they permit the calculation of the focal length and the positions of the principal planes. The type of purely electric or purely magnetic field is found which allows a point-to-point mapping of the object plane upon the image plane. [See Abstr. 903 (1937)]. L. S. G.

537.534.8 : 537.591.1 2053

Cascade production of mesons. PENG, H. W. *Proc. Roy. Irish Acad.*, 49*A*, *pp.* 245–257, *Feb.*, 1944.—In a previous paper [Abstr. 213 (1944)] it was found that a nucleon could produce mesons by collision with other nucleons. If the energy lost by the primary nucleon in a collision is large, a recoil nucleon is produced. This process continues with the formation of a nucleon cascade. The assumption was made that all the energy lost by the primary nucleon was taken up by the meson. This gives agreement with cosmic-ray experiments, but does not give the correct energy distribution or number of mesons. The cascade process is studied in detail to test the validity of the above assumption. It is found that if the nucleon cascade is correctly taken into account, results are obtained which do not differ greatly from those deduced with the aid of the simplifying assumption. A. J. M.

537.59 : 535.14 *see Abstr.* 1993

537.591.1 2054

The method of shower anti-coincidences for measuring the meson component of cosmic radiation. SARABHAI, V. *Phys. Rev.*, 65, *pp.* 250–251, *April* 1 *and* 15, 1944.

537.591.1 : 537.534.8 *see Abstr.* 2053

537.591.15 2055

High-energy particles in Auger showers. ROGOZINSKI, A. *Phys. Rev.*, 65, *pp.* 207–210, *April* 1 *and* 15, 1944.—The results are given of counter experiments carried out at 10 618 ft. (Echo Lake, Colorado) on extensive atmospheric showers of a min. spread of 22 m. An efficient method of investigation of such showers is described. High-energy electrons or photons, initiating a shower below a Pb screen of 10 cm. thickness, are accompanied, above the absorber, by a shower of high particle density, located either in the central part of the core of the Auger shower or in its close neighbourhood.

537.591.2 2056

Note concerning the multiple production of penetrating secondary cosmic rays in lead. HAZEN, W. E. *Phys. Rev.*, 65, *p.* 249, *April* 1 *and* 15, 1944.

537.591.2 2057

The average ionization and energy loss of cosmic-ray mesotrons in air. HAZEN, W. E. *Phys. Rev.*, 65, *pp.* 259–264, *May* 1 *and* 15, 1944.—The average sp. ionization of cosmic-ray mesotrons was determined at sea level and at 100 ft. underground from drop counts along diffuse cloud-chamber tracks. The cloud chamber was operated in such a way that the efficiency of condensation on ions was known. The average sp. ionization, excl. energy transfers > 800 eV, is essentially 50 ion pairs per cm. of air at N.T.P. for both locations. Since a 15% increase is expected for the measurements underground, it is suggested that the high-energy cosmic rays may be protons. If all energy transfers $< 10^4$ eV are included, the average energy loss is $1{\cdot}35 \times 10^6$ eV per g./cm.^{2} of air. The observed cross-sections for energy transfers betw. 800 and 3·200 eV agree with the Rutherford formula when the electron binding is taken into account.

537.591.3 2058

Note on the separation of the electronic and non-electronic components of cosmic radiation. BHABHA, H. J. *Proc. Indian Acad. Sci. A*, 19, *pp.* 23–36, *Jan.*, 1944.—A formula for the depth of the penetration of a cascade as a function of the energy of the primary electron is given [see Abstr. 1976 (1943)], with a simple formula for the end of a shower. Fluctuation plays an important part in determining the ability of an electron to operate 2 counters separated by a given thickness of absorber and increases the number of such electrons 10-fold for thick absorbers. Formulae are given for the number of electrons which enter an absorber of thickness t and result in one or more particles emerging from the other side of the absorber. A new experimental arrangement is described which makes a more effective use of the cascade process for separating the electrons from the penetrating particles.

537.591.3 2059

The method of shower anti-coincidences for measuring the meson component of cosmic radiation. SARABHAI, V. *Proc. Indian Acad. Sci. A*, 19, *pp.* 37–46, *Jan.*, 1944.—A new method of measuring the meson intensity by registering shower anti-coincidences is described. It brings under the field of direct experimental measurements, the slow mesons usually cut out in experiments where lead absorbers are used to filter out the soft electron component. The preliminary results obtained at up to 13 900 ft. in Kashmere are reported. Absorption curves for the meson and the total intensity at various altitudes as well as the altitude intensity curves for the total and the meson component are given.

538.3 : 530.145 2060

A generalized electrodynamics. II. Quantum. PODOLSKY, B., AND KIKUCHI, C. *Phys. Rev.*, 65, *pp.* 228–235, *April* 1 *and* 15, 1944.—[See Abstr. 206 (1943)]. When the Lagrangian from which the field equations are derived contains second and higher derivatives of the generalized field co-ordinates, the

method of quantizing the field equations developed by Heisenberg and Pauli cannot be immediately applied. By generalizing a method due to Ostrogradsky for converting Lagrange's equations of motion of a particle, when higher derivatives are present, into canonical Hamiltonian form, it becomes possible to perform a similar transformation of the field equations. Applying this method to Podolsky's generalized electrodynamics, we obtain the Hamiltonian of the field and double the usual number of generalized co-ordinates and momenta. The quantization of the field follows without any special assumptions.

539.13 : 535.338.42 2061

The asymmetric rotor. II. Calculation of dipole intensities and line classification. CROSS, P. C., HAINER, R. M., AND KING, G. W. *J. Chem. Phys.*, 12, *pp.* 210–243, *June*, 1944.—[See Abstr. 1145 (1943)]. A table of line strengths for rigid asymmetric rotors is given, by which the rel. intensities of all important rotational lines up to $J < 13$ for all bands of any molecule can be calculated, provided the asymmetry is roughly the same in the initial and final states. A classification of the irregularly spaced lines of the asymmetric rotor is made into sub-branches defined by the changes of the K values of the initial level in the limiting prolate and oblate symmetric rotors, and into wings which collect together lines of the sub-branches which have uniformly varying strength and Boltzmann factor, and fairly uniform spacing.

539.13 : 541.64 2062

Molecular weight and molecular-weight distribution in high polymers. *Trans. Faraday Soc.*, 40, *pp.* 217–279, *June*, 1944.—A general discussion containing the following: General introduction, Melville, H. W.; Molecular weight and shape of macro-molecules in solution, Campbell, H., and Johnson, P., [Abstr. 2086 (1944)]; Osmotic pressure of high polymer solutions and molecular weight, Hoff, E. A. W. [Abstr. 1982 (1944)]; The study of the mechanism of polymerization reactions by means of size-distribution curves, Herington, E. F. G. [Abstr. 2084 (1944)]; The kinetics of polymerization reactions, Gee, G., and Melville, H. W. [Abstr. 2085 (1944)]; The melting of crystalline polymers, Frith, E. M., and Tuckett, R. F. [Abstr. 2032 (1944)]; The molecular weights of rubber and related materials. V. The interpretation of molecular-weight measurements on high polymers, Gee, G. [Abstr. 2087 (1944)]; On the degradation of long-chain molecules. I, Jellinek, H. H. G. [Abstr. 2088 (1944)].

539.133 : 535.338.3 *see Abstr.* 2003

539.152 2063

Relativistic wave equations for particles with variable spin. GINSBURG, V. L. *C.R. Acad. Sci. URSS*, 37, 5–6, *pp.* 166–171, 1942.—By a particle (i, j) is meant one capable of being in the states having spins i, j and masses m_i, m_j respectively. The wave equations are set up and studied for the particles $(1/2, 3/2)$ and (1, 2), the former being the simplest model of a proton-neutron. The treatment is formulated throughout in the Lagrange form and, at first, in the absence of a field, although this is later introduced. L. S. G.

539.152.1 2064

A new representation of types of nuclear forces. BUNGE, M. *Phys. Rev.*, 65, *pp.* 249–250, *April* 1 *and* 15, 1944.

539.152.1 2065

On the mixed-meson theory of nuclear forces. JAUCH, J. M., AND HU, N. *Phys. Rev.*, 65, *pp.* 289–290, *May* 1 *and* 15, 1944.

539.153.4 : 535.338.3 *see Abstr.* 2004

539.155.2 : 546.546 2066

Isotope shift in magnesium. MUNDIE, L. G., AND MEISSNER, K. W. *Phys. Rev.*, 65, *pp.* 265–273, *May* 1 *and* 15, 1944.—Previous investigations [Abstr. 2022 (1938)] were repeated and extended by an improved atomic-beam source and a Perot–Fabry interferometer. The values of Meissner were checked to within exp. error. Several new lines were resolved, and their isotope shifts determined. The $3\,^1P - m\,^1D$ series was resolved from $m = 3$ as far as $m = 11$. In this series the values of $\Delta\nu(= \nu_{26} - \nu_{24})$ converge to a value of about $0{\cdot}068$ cm.$^{-1}$ rather than $0{\cdot}056$ cm.$^{-1}$ (Meissner). The isotopic shifts of the members $m = 5$ and $m = 6$ of the series $3\,^1P - m\,^1S$ were measured. The results are discussed in connection with the theoretical work of Vinti, who assumed the splitting to be solely a mass effect. The experimental and theoretical values of $\Delta\nu$ agree in sign, but the former are usually larger by a factor of 2. The $3\,^2D - 4\,^2F$ doublet of Mg II at 4 481 Å was measured; the separation of the 2 components was $(1{\cdot}000 \pm 0{\cdot}002)$ cm^{-1}.

539.16.08 2067

Four-pi solid angle G-M counters. SIMPSON, J. A., JR. *Rev. Sci. Instrum.*, 15, *pp.* 119–122, *May*, 1944.—Two types of Geiger–Müller counters which count the particles in a solid angle $< 4\pi$ are described. The use of thin metal windows permits their use with low-energy β-particles. They are useful for small point sources or in determining the radioactivity of thin foils. Details of the construction are presented. A differential vacuum system for filling thin-window 4π counters is described.

539.16.08 2068

On the rôle of polyatomic gases in fast counters. KORFF, S. A., AND PRESENT, R. D. *Phys. Rev.*, 65, *pp.* 274–282, *May* 1 *and* 15, 1944.—The polyatomic gas serves to quench ultra-violet photons and to quench secondary emission by pos. ions reaching the cathode. The important property of a polyatomic molecule is the large probability of predissociation from excited electronic states. The quenching of ultra-violet photons in the initial avalanche occurs through photo-decomposition of the polyatomic gas. In a fast counter containing a self-quenching mixture, the polyatomic gas has a lower ionization potential than the monatomic constituent. The pos. ions make 10^5 collisions in crossing the counter and the electron transfer probability ensures that the pos. ion sheath, when it reaches the cathode, is composed entirely of polyatomic ions. These are neutralized at about 10^{-7} cm. from the wall and the excited neutral molecules predissociate in 10^{-13} sec. before they can liberate a secondary electron by an inelastic collision with the wall. With no supply of secondary electrons the discharge terminates.

539.16.08 2069

Some phase effects with coincidence proportional counters. MEAKER, C. L., AND ROBERTS, A. *Rev. Sci. Instrum.*, 15, *pp.* 149–151, *June*, 1944.—With some proportional-coincidence amplifiers having a short-time-constant input to the mixer stage, the fraction of the true coincidences measured was a function of both the counter voltages and the absorber between the counters. This effect could be traced to the amplifier characteristics in conjunction with the short time constant before the mixer stage. The paper describes the counters and amplifiers, discusses the cause of the effect, and suggests possible uses.

539.163.2 : [546.711 + 546.73] 2070

Disintegration schemes of radioactive substances. VII. Mn^{54} and Co^{58}. DEUTSCH, M., AND ELLIOTT, L. G. *Phys. Rev.*, 65, *pp.* 211–215, *April* 1 *and* 15, 1944.—[See Abstr. 662, 1155 (1944)]. The radiations emitted by Mn^{54} and by Co^{58} were studied by the magnetic-lens spectrometer and coincidence techniques. Mn^{54} decays by orbital electron capture to an excited state of Cr^{54}, followed by the emission of a 0·835 eMV γ-ray. A study of the X-rays emitted following the capture process indicates that a large fraction of the captured electrons are K electrons. Few, if any, capture transitions lead directly to the ground state. Co^{58} decays to a state of Fe^{58} 0·805 eMV above the ground state which in turn decays by the emission of a single γ-ray. 90% of the disintegrations of Co^{58} occur by K-electron capture. In the remaining 10%, positrons of max. energy 0·47 eMV are emitted. This ratio is consistent with the idea that the transition takes place with a change of angular momentum of 1 unit or 0, whether the parity changes in the transition or not, if the tensor theory of β-decay is correct. The lowest known excited states of Cr^{54}, Fe^{56} and Fe^{58} have excitation energies differing by $< 5\%$.

539.215 2071

The effect of grain shape on the moulding properties of synthetic moulding sands. DAVIES, W., AND REES, W. J. *J. Iron Steel Inst.*, [29 *pp.*], *June*, 1944. *Advance copy.*—The influence of grain shape on the behaviour of sands in synthetic moulding sand mixtures bonded with clays, core oils and core compounds was investigated [see Abstr. 251 (1944)]. The grain angularity varies with the source from which the sand was derived originally, the conditions under which the deposit accumulated and the degree of consolidation of the deposit. Typical examples of the effect of grain shape on the properties of synthetic moulding of core sand mixtures are given; for sands having comparable mechanical gradings, the strength of mixtures prepared with angular sands is lower than that of mixtures based on rounded sands, and the surface friability of the dried mould or core increases with the angularity of the sand. These differences are attributed to the poorer packing properties of the angular sands and to differences in the grain relationships in angular and rounded sands. The distribution of bulk density in moulds and cores is analysed, and the relationship of the bulk-density gradient to the moulding properties is discussed and illustrated. Some methods of minimizing the disadvantageous effect of angularity of grain are suggested.

539.216.1 : 677 2072

Extension of the conventional twist multiple formula to new materials. GERHARD, S. L. *J. Appl. Phys.*, 15, *pp.* 474–476, *June*, 1944.—Mathematical relations between a few geometric yarn properties are used to develop the concept of rel. density. With the aid of this idea it is possible to deal with yarns made of different materials but having the same rel. density as though they were made of the same material, so far as their geometric properties are concerned. A simple formula is derived to convert twist multiples from one yarn count system to another.

539.219.2 2073

The effect of a hole on certain stress distributions in aeolotropic and isotropic plates. HOLGATE, S. *Proc. Camb. Phil. Soc.*, 40, *pp.* 172–188, *June*, 1944.—Green's method [Abstr. 2151 (1942)] is used to find the stress distributions arising when stresses are produced by isolated forces acting at points on, or near to, the edge of a circular hole in a plate. Two symmetrical problems are treated: (i) 2 equal and opposite forces act at the extremities of a diameter, (ii) such forces act at the ends of a chord parallel to an axis of symmetry of the material. The types of problem arising from unbalanced forces at points on the boundary are discussed and the problem of an isolated force acting at a point near to, but not on, the edge of the hole is solved when the force acts along or $\perp$ that diameter through the point, which is parallel to an axis of symmetry. The hoop stress round the edge of the hole is evaluated numerically in various cases for specimens of spruce and oak which are highly aeolotropic materials. [Abstr. 34 (1939)]. L. S. G.

539.3 : 678 2074

The retraction of stretched rubber. STAMBAUGH, R. B. *Phys. Rev.*, 65, *p.* 250, *April* 1 *and* 15, 1944.

539.31 : 548.0 : 536.71 *see Abstr.* 2039

539.319 2075

Elastico-plastic state of a tube in the presence of strain-hardening in the material. SOKOLOVSKY, W. *C.R. Acad. Sci. URSS*, 37, 5–6, *pp.* 160–165, 1942.—A mathematical study is made of the elastico-plastic stress in a cylindrical tube under the action of internal and external pressure when strain-hardening in the material takes place. The plastic domain consists of the annular space $a < r < c$ and the elastic domain is the space $c < r < b$, the outer and inner radii of the tube being b and a. L. S. G.

539.38 : 669.14 2076

Internal stress created by plastic flow in mild steel, and stress/strain curves for the atomic lattice of higher carbon steels. SMITH, S. L., AND WOOD, W. A. *Proc. Roy. Soc. A*, 182, *pp.* 404–414, *June* 16, 1944.—The systematic departure from Hooke's Law [Abstr. 1428, 3107 (1942)] indicates that the external applied stress above the yield is no longer balanced by displacement of the atoms but also by secondary internal stress brought about by the process of plastic flow; this secondary stress, being of a permanent nature, can be measured by the residual lattice strains exhibited by the lattice after removal of the external stress. These residual strains are measured in various directions to the stress direction for mild steel subjected to tension, and it is shown that the lattice after

tension exhibits a longitudinal compression and a transverse expansion in the ratio of 2 : 1, which means that the density of the material is thereby kept constant. Comparisons of X-ray and mechanical measurements show that the hysteresis loop exhibited by the external stress/strain curve of mild steel after overstrain can disappear and the linear elastic relation be recovered without any corresponding change in the internal stress. When the elastic range is extended by overstrain in tension, there is no symmetrical increase in the elastic range in subsequent compression. The lattice stress/strain curves are also obtained for a 0·4% C steel (partially pearlitic) and a 0·8% C steel (pearlitic), and by comparison with the results on pure iron and 0·1% C steel (annealed) it is shown that the max. residual internal strain developed by the lattice increases markedly with the fineness to which the crystallites can be broken down by the plastic deformation.

539.4.01 : 536.495 = 3 2077

Effect of temperature on mechanically strained organic materials. FREY, K. *Schweiz. Arch. angew. Wiss. Techn.*, 10, *pp.* 39–56, *Feb.*, 1944.—A review of existing data relating to the suitability and temperature limitations of various plastic materials available for use in equipment under strained conditions. The sections include, effect of temperature and time on the tension/extension diagram, dependence of elasticity and plasticity on temperature and stress, connection between chemical structure and mechanical properties, the practical determination of the resistance to deformation on heating and the permanent injury resulting from excessive heating. A test method is given for determining this last effect. R. W. P.

539.434 : 669.14 2078

Creep properties of steels utilized in high-pressure and high-temperature superheater and steam-pipe practice. I. Carbon steels. TAPSELL, H. J. *Proc. Instn Mech. Engrs, Lond.*, 151, 1, *pp.* 54–62, 1944.—[Abstr. 1596 B (1944)].

539.434 : 679.5 2079

Creep properties of moulded phenolic plastics. TELFAIR, D., CARSWELL, T. S., AND NASON, H. K. *Mod. Plast.*, *pp.* 37–44, *Feb.*, 1944.—Gives results of tests on phenolic plastics containing woodflour, chopped canvas (rag), cotton cord, asbestos and mica. Data were also obtained for an unfilled resin. Tests were carried out at temperatures up to 195°F.

E. R. A.

539.501 2080

Evaluation of rheological constants from tensile and compressive tests. LETHERSICH, W. *J. Sci. Instrum.*, 21, *p.* 111, *June*, 1944.—Correspondence [see Abstr. 940 (1944)].

539.501 : 541.182 : 677 : 532.13 *see Abstr.* 1970

539.536 : 669.1 : 621.94 2081

Wear-resisting materials for lathe construction. DAYTON, R. W., LORIG, C. H., AND ADAMS, R. E. *Trans. Amer. Soc. Mech. Engrs*, 66, *pp.* 199–204, *April*, 1944.—[Abstr. 1572 B (1944)].

539.63 : 552.517.1 2082

Pebbles, natural and artificial. Their shape under various conditions of abrasion. RAYLEIGH, LORD. *Proc. Roy. Soc. A*, 182, *pp.* 321–335, *June* 16, 1944.—[See Abstr. 758 (1943)]. The paper deals with the formation of artificial pebbles under controlled conditions, and their comparison with the pebbles found in nature. Symmetrical pebbles having an approx. figure of revolution are chiefly considered. Marble pebbles, made experimentally by attrition of rectangular blocks by fragments of hard steel, are shown in comparison with natural pebbles. An alternative way is by "pothole" action. The experimental pothole is a cylindrical vessel containing water with a paddle revolving co-axially with it. Either the bottom or the wall of the vessel may be made of abrasive material. When the bottom is abrasive, the pebbles are of such a shape that they lie inside a spheroid of the same polar and equatorial diameter in contrast to the previous case, where they lie outside. When the sides are abrasive, the form tends to the spherical. As regards concave pebbles, the discussion in the former paper is withdrawn. A new method of experiment is used, depending on the pitting of a small square of sheet glass, revolved in a box with the abrasive. If many broken flints are used, each comparable in size with the glass, the latter is chiefly pitted in the middle. If a single flint only is used, the pittings on the polished surface are uniformly distributed.

541.123.2 : 532.77 2083

On the calculation of certain higher-order Bethe approximations. ORR, W. J. C. *Trans. Faraday Soc.*, 40, *pp.* 306–320, *July-Aug.*, 1944.—The combinatory factor in the grand partition function for an assembly of double molecules arranged on a plane array of sites can be calculated approx. by the Bethe method. The present work improves the approx. solutions obtained for this problem [Abstr. 1882, 1946 (1939)]. When the equilibrium conditions are applied in a properly consistent manner to the molecules arranged on the representative group of sites considered by the Bethe method, the higher-order approximations rapidly converge and the deviations from the first-order result can be expressed in an explicit analytical form. [See Abstr. 1037 (1943)].

541.123.2.034.6 : 536.77 *see Abstr.* 2042

541.127 : 541.64 2084

The study of the mechanism of polymerization reactions by means of size-distribution curves. HERINGTON, E. F. G. *Trans. Faraday Soc.*, 40, *pp.* 236–240, *June*, 1944.—Experimental complications in the study of size-distribution curves are indicated. In order to obtain information on the mechanism from distribution curves the degree of polymerization must be known. Most information can be obtained if the fraction polymerized is small and if the rate of initiation is kept const. during this reaction period. Three main types of distribution curves may be distinguished; these are discussed in terms of the mechanism terminating the life of an active growing radical.

541.127 : 541.64 2085

The kinetics of polymerization reactions. GEE, G., AND MELVILLE, H. W. *Trans. Faraday Soc.*, 40, *pp.* 240–251, *June*, 1944.—A general treatment of the kinetics of polymerization reactions is given to cover the extreme conditions in which the lifetime of chain growth is (*a*) small, and (*b*) large compared with the half-life of the monomer. Case (*a*) is considered on the basis of the assumption that the velocity

coefficients do not depend on molecular size. Case (*b*) is considered for propagation coefficients which are (i) independent, and (ii) dependent on molecular size. In addition, the distribution of molecular sizes is computed in those cases where the mathematical difficulties are not insurmountable.

541.127.3 : 676 : 536.4 *see Abstr.* 2030

541.132.3 : 537.363 *see Abstr.* 2048

541.18.043 : 532.133 : 541.24 *see Abstr.* 2086

541.182 : 677 : 539.501 : 532.13 *see Abstr.* 1970

541.182.5 : 537.29 *see Abstr.* 2046

541.183 : 532.691 : 531.72 = 3 *see Abstr.* 1966

541.183.25 : 536.421.4 *see Abstr.* 2033

541.24 : 532.133 : 541.18.043 2086

Molecular weight and shape of macro-molecules in solution. CAMPBELL, H., AND JOHNSON, P. *Trans. Faraday Soc.*, 40, *pp.* 221–233, *June*, 1944.—Viscosity, sedimentation-velocity and diffusion measurements, were made on solutions in acetone of some commercial nitrocelluloses, and compared with similar measurements on the so-called globular proteins. Using various well-known equations connecting viscosity and molecular shape, and making certain assumptions, mol. wt. values are calculated for nitrocellulose fractions from viscosity measurements. For the calculation of mol. wt. from sedimentation-velocity and diffusion measurements, the experimental requirements for accurate work are pointed out. Data so far obtained agree with the view that the nitrocellulose molecule in acetone is a long, almost completely stretched chain of nitrated glucosidic residues, whose chain dia. is increased by solvation, and in which some little flexibility may be assumed.

541.24 : 532.712 *see Abstr.* 1982

541.24 : 532.712 : 532.13 2087

The molecular weights of rubber and related materials. V. Interpretation of molecular-weight measurements on high polymers. GEE, G. *Trans. Faraday Soc.*, 40, *pp.* 261–266, *June*, 1944.—A mathematical discussion gives a new theoretical justification for the osmotic method and draws attention to the conditions under which the viscosity method may be employed. Unless an ultra-centrifuge is available, abs. mol. wt. determinations must be based ultimately on osmotic data. Viscosity measurements furnish a method of interpolation and give reliable results for homogeneous linear polymers. Conclusions on mol. wt. distribution must be supplemented by a fractionation, but a useful guide to the homogeneity of a polymer known to be of linear structure is given by the ratio of the viscosity and osmotic mol. wts. N. M. B.

541.57 : 535.375.5 *see Abstr.* 2013

41.64 2088

On the degradation of long-chain molecules. I. JELLINEK, H. H. G. *Trans. Faraday Soc.*, 40, *pp.* 266–273, *June*, 1944.

541.64 : 539.13 *see Abstr.* 2062

541.64 : 541.127 *see Abstr.* 2084, 2085

544.65 : 535.371 *see Abstr.* 2009

546.17 : 535.338.4 *see Abstr.* 2005

546.172.6 : 535.338.4 *see Abstr.* 2006

546.546 : 539.155.2 *see Abstr.* 2066

[546.711 + 546.73] : 539.163.2 *see Abstr.* 2070

[546.73 + 546.711] : 539.163.2 *see Abstr.* 2070

547.458.6 : 535.324 *see Abstr.* 2002

547.599.6 : 532.14 : 535.324 *see Abstr.* 2001

548.0 : 535.343.2-1 : 535.375.5 *see Abstr.* 2012

548.0 : 539.31 : 536.71 *see Abstr.* 2039

548.0 : 621.357.7 2089

The structure of electro-deposited chromium. A correction. HUME-ROTHERY, W., AND WYLLIE, M. R. J. *Proc. Roy. Soc. A*, 182, *p.* 415, *June* 16, 1944.—[See Abstr. 2444 (1943)].

548.55 : 535.43 *see Abstr.* 2020

550.341 : 517.9 *see Abstr.* 1941

550.372 : 551.594.221 : 621.316.98 = 3 2090

Notes on the investigation of geoelectrical lightning hazards. FRITSCH, V. *Beitr. Geophys.*, 57, 1, *pp.* 65–108, 1940.—Statistical data are given on the damage due to lightning reported by German Insurance Companies in 1939. The effect of local variations in soil resistivity, on the liability of direct lightning hits and on the protective range of lightning conductors, is discussed and the importance of seasonal variations on the earthing resistance of protective systems is emphasized. With a view to investigating these effects, a test field is described which is arranged in a Bohemian village which appears to be particularly prone to damage by lightning. Several cases of past damage, and the methods of investigation to be adopted, are described. R. H. G.

550.372 : 551.594.221 : 621.316.98 = 3 2091

Note on the work done in 1941 at the lightning test field of Absroth. FRITSCH, V. *Beitr. Geophys.*, 59, 3–4, *pp.* 306–330, 1943.—Cases of lightning damage in the test field [see Abstr. 2090 (1944)] during 1941 are described. For the neighbouring German province of Saxony, detailed statistical information is given on lightning damage to buildings during 1927–1940. Various methods for measuring earthing resistances are discussed and the results obtained with test electrodes are investigated with respect to yearly and monthly variations, and the effects of rainfall. R. H. G.

551.594.221 : 621.316.98 : 550.372 = 3 *see Abstr.* 2091

552.517.1 : 539.63 *see Abstr.* 2082

578.088.6 : 536.421.4 *see Abstr.* 2034

662.753 : 536.633 *see Abstr.* 2035

662.753 : 536.662 *see Abstr.* 2036

669.1 : 621.94 : 539.536 *see Abstr.* 2081

669.14 : 539.38 *see Abstr.* 2076

669.14 : 539.434 *see Abstr.* 2078

676 : 541.127.3 : 536.4 *see Abstr.* 2030

677 : 539.216.1 *see Abstr.* 2072

677 : 539.501 : 541.182 : 532.13 *see Abstr.* 1970

677.11 : 532.13 *see Abstr.* 1971

678 : 539.3 *see Abstr.* 2074

679.5 2092

Nylon. WARRINGTON, C. J. *Engng J. Can.*, 27, *pp.* 285–287, *May*, 1944.—[Abstr. 1601 B (1944)].

7.01 : 535.6 *see Abstr.* 2022